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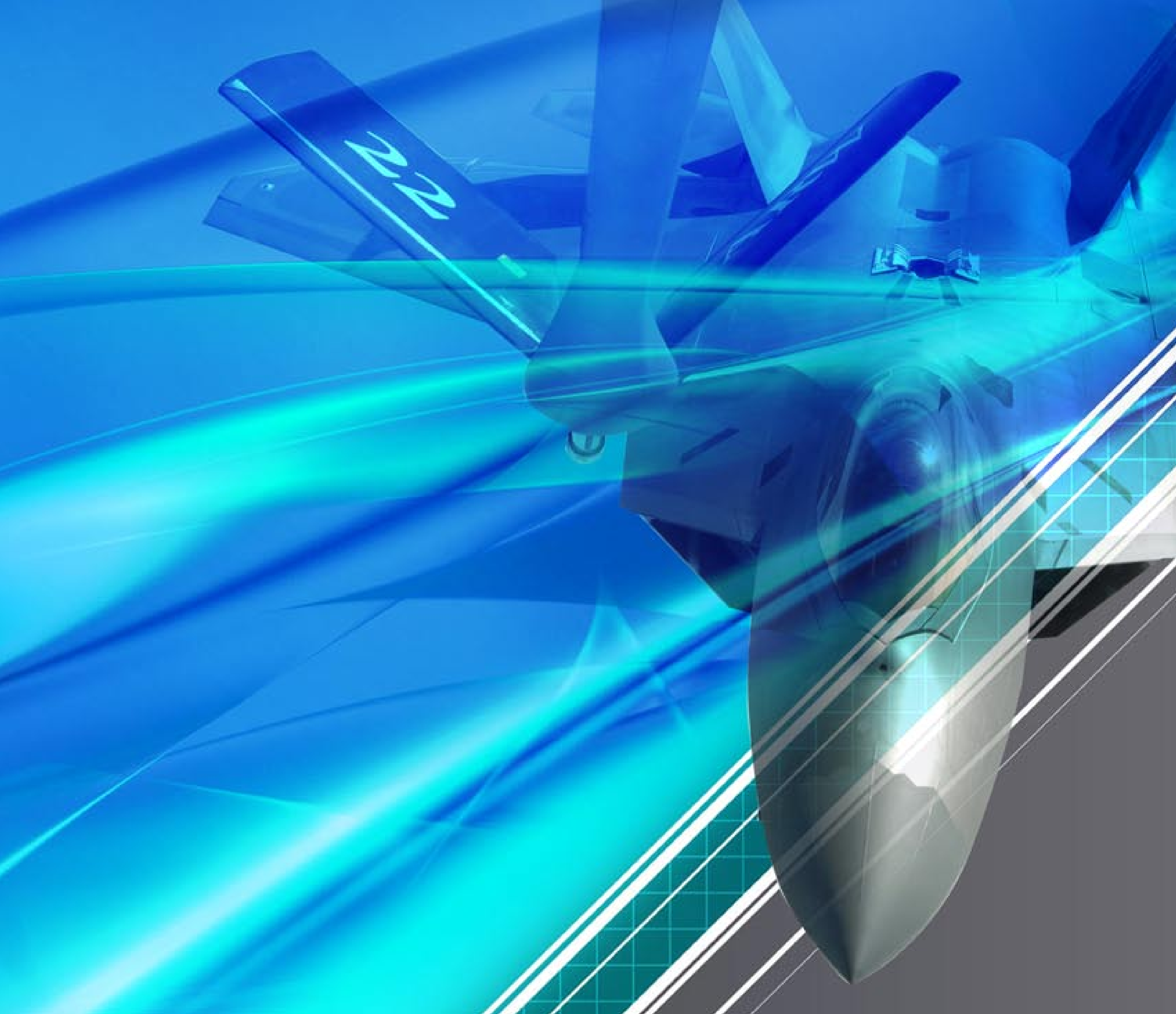
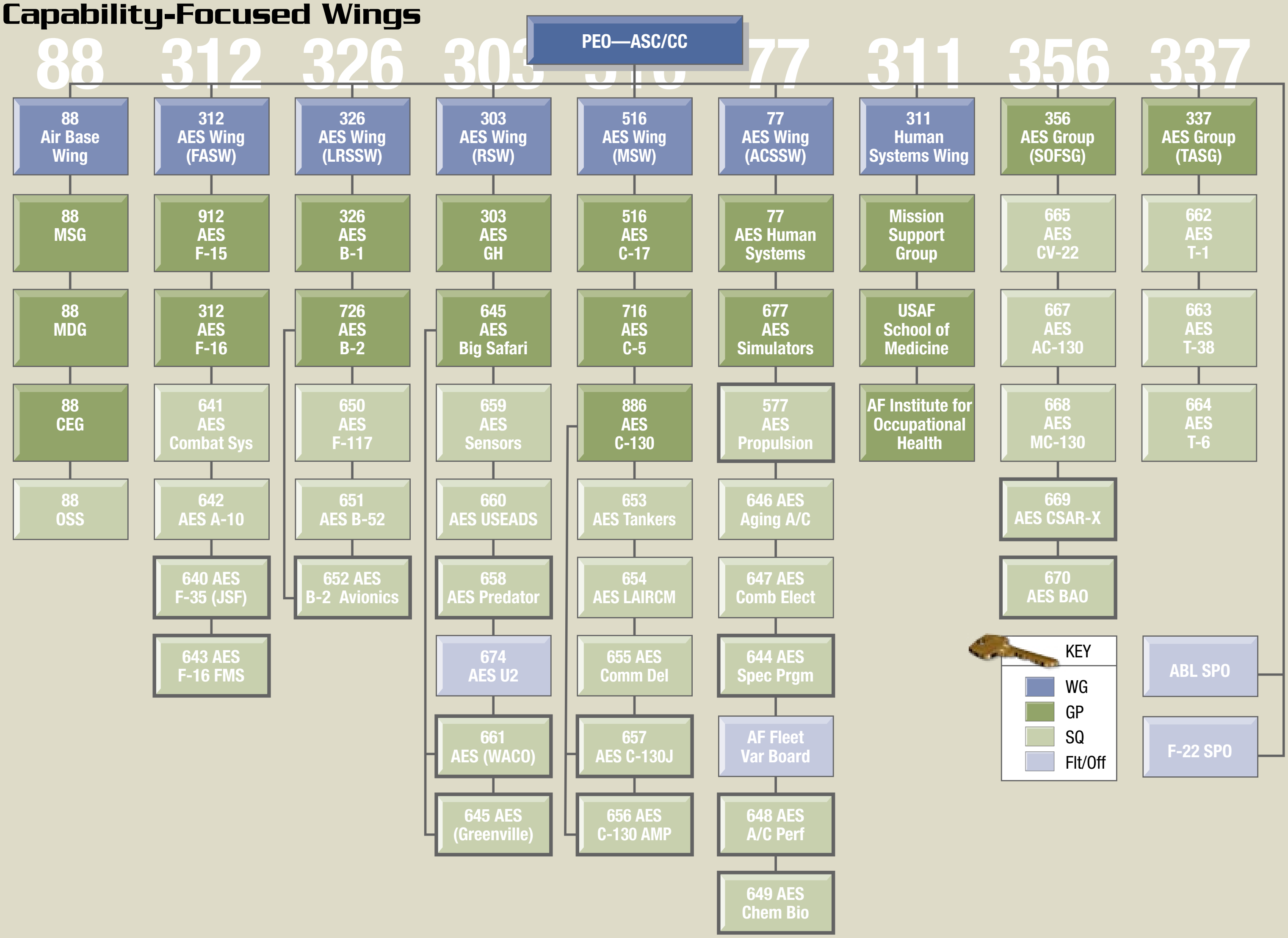


Aeronautical Systems Center (ASC)

Capability-Focused Wings



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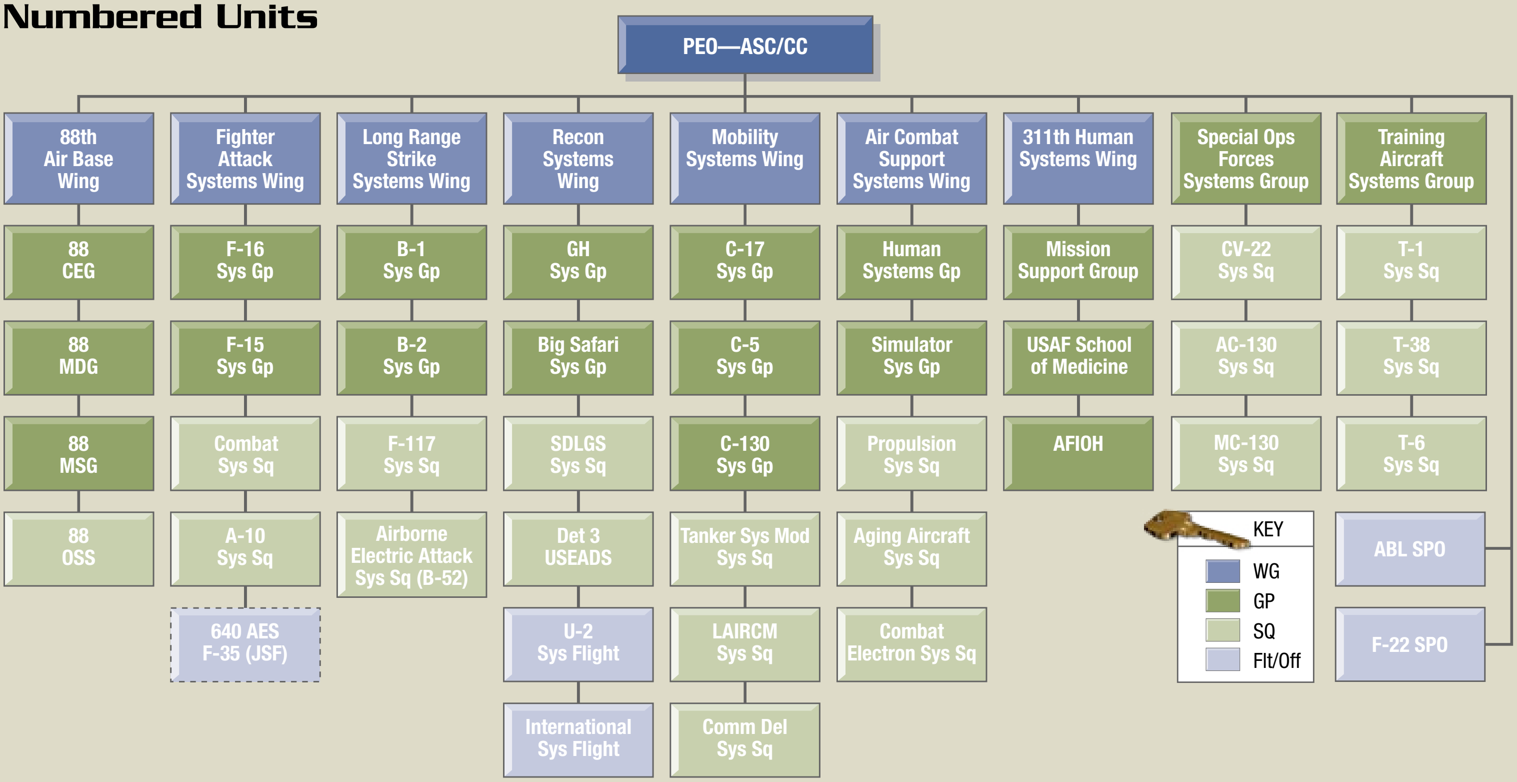

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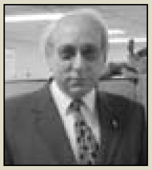
The MONITOR

is a quarterly publication of Aeronautical Systems Center, Acquisition Environmental, Safety, and Health Division, Pollution Prevention Branch (ASC/ENVV). The purpose of this publication is to advance the people, policies, processes, and tools that integrate Environment, Safety, and Occupational Health (ESOH) into systems engineering and across the life cycle of ASC's weapon systems and end items.

ASC/ENVV does not endorse the products featured in this magazine. The views and opinions expressed in this publication are not necessarily those of ASC. The current and historical issues of this magazine are located at http://www.engineering.wpafb.af.mil/esh/monitor.asp and at the following Community of Practice (CoP): https://www.afkm/asps/CoP/ClosedCoP.asp?Filter=OO-AQ-AS-19.

All inquiries or submissions to the MONITOR may be addressed to:



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In This Issue

This issue of the MONITOR puts the "Management Spotlight" on key Aeronautical Systems Center (ASC) personnel that are responsible for integrating Environment, Safety, and Occupational Health (ESOH) into the systems engineering process. It includes an interview with Mr. Ted Grady, the ASC, Acquisition Environmental, Safety, and Health Division, Pollution Prevention Branch (ASC/ENVV) Branch Chief and provides a listing of the points of contact (POCs) for ASC Programs, including the current Chief Engineers, Directors of Engineering (DOEs), Environmental Managers, System Safety Managers, Corrosion Managers, and Air Force Research Laboratory Co-Locates.

DEICING/ANTI-ICING is the **FEATURE TOPIC** for this issue and is centered around the activities of the Air Force Materiel Command (AFMC) Ad Hoc Deicing Working Group. The first article provides background information on the use of deicing/anti-icing agents for aircraft and runways, the formation of the AFMC Ad Hoc Deicing Working Group, and their future challenges. A second article summarizes the Deicing Workshop held at Wright Patterson AFB in June 2006. The article presents some of the operational and general deicing/anti-icing issues discussed during the workshop. A third article presents a critical issue that was highlighted at the AFMC Deicing Workshop regarding material compatibility of deicing/anti-icing agents used on aircraft. The article outlines this common concern across government and industry and then summarizes the current Air Force efforts to mitigate the problem.

The **INFORMATION CROSSFEED** section summarizes the Propulsion Environmental Working Group (PEWG) conference held in August 2006 and co-sponsored by the Naval Air Depot (NADEP), Cherry Point. The PEWG has set an example for effective partnering among military buyers and maintainers, industry, and the science & technology community to discover, prove, and insert technologies that effectively solve engine related problems for the warfighters! A second article provides a short summary of the F-22 Environmental and Health Working Group (E&HWG) Meeting held at Tyndall AFB this summer. Some of the current ongoing projects being executed through Aeronautical Systems Center, Acquisition Environmental, Safety, and Health Division (ASC/ENV) are provided in a summary sheet format. △

Management Spotlight

Interview with Ted Grady, Aeronautical Systems Center, Acquisition Environmental, Safety, and Health Division, Pollution Prevention Branch (ASC/ENVV) Branch Chief

Q1. Can you briefly discuss how ASC/ENVV provides Environment, Safety, and Occupational Health (ESOH) support to the ASC Wings as well as the government owned contractor operated (GOCO) facilities?

We provide guidance and training to the Wing ESOH Points of Contact (POCs) to help them identify and reduce the ESOH risk to their programs or at the GOCOs. We provide products to the Wings such as analysis of changing environmental regulations and their potential impacts to the aerospace industry and weapon system acquisition. We work with AFMC/A7CV to obtain funding for the qualification of proposed hazardous material substitutes, and we work with AFMC/SG to assess the occupational health risk of specific weapon system materials or proposed substitutes. We coordinate with SAF/AQRE on developing appropriate National Environmental Policy Act guidance for weapon system acquisition programs. We have developed tools, in conjunction with the systems engineering toolset, which consolidate ESOH requirements in one place and assess their risk to the Wings' programs. We developed a template to help Wings complete their Programmatic Environmental Safety and Health Assessments, which are required for all programs regardless of their acquisition category. We also work to maintain consistent implementation of ESOH requirements across all the Wings at ASC by hosting bi-monthly ESOH cross-feed meetings.

Q2. What are some the challenges to your current mission based on the new re-organization of ASC?

Many of the ESOH Wing POCs responsibilities were reprioritized to cover other non-ESOH engineering areas within the Wings. A lot of the connectivity to the ESOH Senior Function Office (former Home Office) has been diminished as ESOH POCs focus more on the other tasks. We continue to offer training and work centralized efforts but only a few of the ESOH POCs reap the benefits of these efforts by attending the meetings where this information is presented.

Q3. What are some of the top priorities for your Branch? What are some of the current initiatives you are executing to meet these goals?

Training is our top priority. We want to ensure our Wing ESOH POCs, Chief Engineers, Directors of Engineering (DOEs), and Program Managers understand the ESOH responsibilities for their programs. We offer different levels of training such as acquisition ESOH overviews, two hour awareness training and detailed "how to" training. The first two areas were addressed during DOE meetings and ASC Focus Week training. We are currently revising a previous acquisition ESOH course to provide more detailed training on what ESOH steps to accomplish during different life cycle phases. It is challenging to train everyone due to turn over and people assigned to work ESOH part time.

Q4: What are the remaining challenges for integrating ESOH into systems engineering for ASC weapon systems? What support do you need from the DOEs or the weapon systems pollution prevention community at large to meet these challenges?

Our biggest challenge is expressing ESOH risk in terms the Chief Engineers, DOEs and Program Managers understand so adequate resources are committed to these ESOH areas. Running the new ESOH Programmatic Risk Tool for acquisition programs is now required by ASC Policy. This should help ensure Chief Engineers, DOEs, and Program Mangers adequately plan for their systems' ESOH requirements to reduce programmatic risk to an acceptable level. The DOEs can also support reducing ESOH technical risk by responding to our annual data calls requesting identification of their ESOH needs or problem areas.

Q5: You were the System Safety Branch Chief prior to your current position. What experience did you take to that position from your Environmental background and what experience from System Safety do you find useful in your current position?

"Training is our top priority. We want to ensure our Wing ESOH POCs, Chief Engineers, Directors of Engineering (DOEs), and Program Managers understand the ESOH responsibilities for their programs. We offer different levels of training such as acquisition ESOH overviews, two hour awareness training and detailed "how to" training. The first two areas were addressed during DOE meetings and ASC Focus Week training. We are currently revising a previous acquisition ESOH course to provide more detailed training on what ESOH steps to accomplish during different life cycle phases. It is challenging to train everyone due to turn over and people assigned to work ESOH part time."

As the Safety Branch Chief, I tried to increase the coordination between the environmental and safety POCs to integrate our ESOH approach. There is need to ensure hazardous materials, identified on the weapon system or in support of the weapon system, are integrated into Safety's Operational Support Hazard Analysis and other analyses. This ensures proper personal protective equipment is identified and appropriate cautions and warnings are developed. It also helps identify high risk areas where an alternative material should be qualified and implemented. I supported System Safety's involvement in the development of the ESOH Programmatic Risk Tool to help integrate environmental and safety considerations. I also believe the newly formed ESOH Council, chaired by the ASC Vice Commander will help integrate and highlight ESOH issues and how they could impact weapon system acquisition.

Q6. You attended the F-22 Environmental & Health Working Group (E&HWG) Meeting held at Tyndall AFB (see related article on page 31 and 32). Can you provide your insights and impressions about the activities of this group?

I was extremely impressed by the cross section of users, contractors, test centers and future aircraft programs represented at this E&HWG. From a personal stand point, having worked on the F-22 during its development, it was very gratifying to see so many F-22s in one place. It is always good to get a reality check from the users and to see what ESOH improvement efforts worked or what still needs improvement. The users at Tyndall AFB seemed very appreciative of the hazardous material reductions accomplished through the F-22 ESOH program. They also shared some areas where their maintenance efforts are not optimal due to ESOH constraints. The E&HWG is very interested in working these areas and we [the ESOH Senior Functional Office] want to help them in these areas.

Q7. You also attended the Summer 2006 Propulsion Environmental Working Group (PEWG) Meeting (see related article on pages 28 to 31). What are the benefits of the work conducted by this organization to your mission and goals?

It was great to see the types of technology and substitutes that the other Original Equipment Manufactures (OEMs) and other government agencies are working on. In addition to reducing ESOH risk on the engines, these technologies can also be qualified for use on aircraft. Ultimately, our ESOH substitutions must be embraced by the OEMs, Air Logistics Centers (ALCs), and Program Offices to ensure their implementation and sustainment. The PEWG is an excellent partnering opportunity to perform joint qualification efforts and save money on these efforts.

Q8. I understand the Deicing Workshop held this summer and sponsored by the AFMC Ad Hoc Deicing Working Group, was a success (see related Deicing/Anti-Icing articles on pages 11 to 25). What is the value added of the Working Group and such types of workshops in addressing Deicing cross-cutting issues for the AF?

This group also cuts across other government agencies, the commercial airlines industry, the Canadian Military and international deicing users. The efforts in partnering, crossfeed of technology, and cost savings was incredible. We need to continue our work to incorporate military requirements into the commercial deicing and anti-icing standards to eliminate the cost to the government of performing military unique qualification and compatibility testing. Hopefully, the finalization and signature of the group's charter will help them obtain better recognition and participation in their ongoing efforts, and clarify their ability to obtain funding.

Q9. In a nutshell, what is your message to the ASC systems engineer, the OEM in manufacturing, or the maintainer in the field for reducing the ESOH burden?

For new acquisition programs, include ESOH personnel in your acquisition strategy planning, material selections and design reviews. For new or legacy systems, identify your program's ESOH burdens to your ASC ESOH Program Office or Wing POC. We will help them search for existing solutions or help them develop and fund projects to qualify new solutions. Remember ESOH is not detrimental to your cost, schedule and performance goals. We have several hazardous material substitution efforts that have improved material application, reduced waste, eliminated cumbersome personal protective equipment, reduced cycle time and reduced life cycle cost. We can only help solve the ESOH problems you tell us about.

Points of Contact for Aeronautical Systems Center (ASC) Programs

Chief Engineers, Directors of Engineering (DOEs), Environmental Managers, System Safety Managers, Corrosion Managers, and Air Force Research Laboratory Co-Locates

Point of Contact	Organization	Supported Program
Chief Engineers		
Mark T. Adduchio	677 AESG	Simulator Systems Group
Deborah A. Bailey	726 AESG	B-2 Systems Group
Mark Bottenfield	658 AESS/EN	Predator Systems Squadron
Kevin Burns	912 AESG	F-15 Systems Group
James Crouch	337 AESG	Training Aircraft Systems Group
Donald Edwards	ASC/YF	F/A-22 Systems Program Office
Mike Eviston	647 AESS	Combat Electronics Squadron
Mark Fraker	312 ASW	Fighter Attack Systems Wing
Patrick Grebinski	641 AESS	Combat Systems Squadron
Paul Harvey	326 AESG/ENE	B-1 Systems Group
William J. Innes	ASC/YFXO	CV-22 Special Operations Forces Systems Group
Richard Lee	303 AESW/XR	Predator Systems Squadron, UAV
William Marks	650 AESS	F-117 Systems Squadron
Donald Sedor	326 AESG	B-1 Systems Group
Anthony G. Smith	662 AESS/EN	T-1 Training Aircraft Systems Squadron
Gary Stanley	516 AESW	Mobility Systems Wing
Howard Strahan Jr.	77 AESG	Human Systems Group
Douglas Stukenborg	577 AESG	Propulsion Systems Squadron
Cheryl Zelasco	716 AESG	C-5 Systems Group
Directors of Engineering (DOEs)		
Terrell D. Allen	ASC/YFR	F/A-22 Systems Program Office
Clay N. Appleton	312 AESW/EN	Fighter Attack Systems Wing
Douglas E. Atkinson	ASC/AE	Acquisition Excellence
Joyce E. Childress	716 AESG/CC	C-5 Systems Group
Frank Grimsley	303 AESW/EN	Reconnaissance Systems Wing
David Irwin	577 AESG/EN	Propulsion Systems Squadron
Anne Kreider	ASC/ENAS	Acquisition Avionics Engineering Div, Integrated Avionics, Computer/ Software Systems
Karl D. Kuhlke	326 AESW/EN	Long Range Strike Systems Wing
Robert LeBlanc	AFRL/SNS	Air Force Research Laboratory, Sensors Directorate
Forest L. Oberschlake	664 AESS/EN	JPATS (Joint Primary Aircraft Training System)
John Slye	516 AESG/EN	C-17 Systems Group
Yvette Weber	303 AESG/EN	Global Hawk Systems Group
Jordan Wescott	ASC/XR	Capabilities Integration Directorate Engineering Design & Analysis Div.

Points of Contact for Aeronautical Systems Center (ASC) Programs (continued)

Point of Contact	Organization	Supported Program
Directors of Engineering (DOEs) (continued)		
Theresa Wright	577 AESG/YN	Propulsion Systems Squadron
James J. Yankel	356 AESG/EN	Special Operations Forces Systems Group
Donna Zelik	516 AESG/CSS	C-17 Systems Group
ASC/ENV Environmental Managers		
ASC/ENV Civilian Collocates		
Steven R. Swanson	677 AESG/EN	Simulator Systems Group
ASC/ENV Military Collocates		
Capt Daryl B. Brezina	ASC/YFSF	F/A-22 Systems Program Office
Wing POCs		
1st Lt Sonia M. Bechtloff	577 AESG/YJ	77 AES Wing (Agile Combat Support)
Capt Andrew Clewett	312 AESG/EN	912 AES Group (F-15)
Lavera Floyd	669 AESS/THE	356 AES Group (Special Operation Forces)
Alexei Lozada-Ruiz	664 AESS/EN	337 AES Group (Training Aircraft)
Jared E. Scott	ASC/YFR	F/A-22 Systems Program Office
John H. Stallings	516 AESW/EN	516 AES Wing (Mobility)
Maj. Gary C. Wright	516 AESG/ENSI	516 AES Group (C-17)
Mary Wyderski	312 AESG/EN	312 AES Wing (Fighter Attack)
System Safety Managers		
Boyce Black	356 AESG/XR	Special Operations Forces Systems Group
Michael Botwin	640 AESS	F-35 Joint Strike Fighter
Lt.Col. David Brawley	ASC/YF	F/A-22 Systems Program Office
Ed Brumbaugh	ASC/YF	F/A-22 Systems Program Office
Preston H. Davis	516 AESG	C-17 Systems Group
Lt. Col. Donald L. Jackson	ASC/SES	Acquisition Safety Directorate/Ground Safety
Kenneth Donoff	647 AESS/TW	Combat Electronics Squadron
Maj. Ralph Korthauer	337 AESG/EN	Training Systems Aircraft Group
Robert Linzmeier	650 AESS/ENE	F-117 Systems Squadron
Sandra Lovelace	577 AESG/YM	Propulsion Systems Squadron
Mitch Lustig	ASC/SES	Acquisition Safety Directorate/Ground Safety
2nd Lt. Michael Madzey	912 AESG/EN	F-15 Systems Group
2nd Lt. Hanz Miller	658 AESS/EN	Predator Systems Squadron
Rodney Paxson	303 AESG/SI	Global Hawk Systems Group
Douglas Peterson	ASC/YF	F/A-22 Systems Program Office
James Sablotny	312 AESG/EN	F-16 Systems Group

Points of Contact for Aeronautical Systems Center (ASC) Programs (continued)

Point of Contact	Organization	Supported Program
System Safety Managers (continued)		
Sandra Lovelace	577 AESG/YM	Propulsion Systems Squadron
Mitch Lustig	ASC/SES	Acquisition Safety Directorate/Ground Safety
2nd Lt. Michael Madzey	912 AESG/EN	F-15 Systems Group
2nd Lt. Hanz Miller	658 AESS/EN	Predator Systems Squadron
Rodney Paxson	303 AESG/SI	Global Hawk Systems Group
Douglas Peterson	ASC/YF	F/A-22 Systems Program Office
James Sablotny	312 AESG/EN	F-16 Systems Group
Judith Schiller	677 AESG/EN	Simulator Systems Group
John Szelog	ASC/YF	F/A-22 Systems Program Office
Harry Tompkins	516 AESG	C-17 Systems Group
Clifton Turner	ASC/SES	Acquisition Safety Directorate/Ground Safety
Richard Wetzel	664 AESS/EN	JPATS (Joint Primary Aircraft Training System)
Corrosion Managers		
Paul Hoth	501 ACSS/GFLB	F-16 Systems Group
Timothy Kalt	326 AESG/ENE	B-1 and B-2 Systems Groups
Pamela Kobryn	640 AESS/EN	Joint Strike Fighter, Air Vehicle
Brian Koehl	555 ACSS/GFEA 3	B-1 Systems Group
Richard Lee (Chief Engineer)	303 AESW/XR	Predator Systems Squadron, UAV
Joseph Leone	ASC/YFR	F/A-22 Systems Program Office
Stephen Schneider	303 AESW/EN	Global Hawk Systems Group, UAV
Deborah Shaw	515 AESG	C-17 Systems Group
John Stephens	830 ACSG/GFEAB	F-15 Systems Group
AFRL Co-Locates		
Diane Baker	726 AESG/VA	B-2 Systems Group
Pamela Kobryn	640 AESS/EN	Joint Strike Fighter, Air Vehicle
Brian Milligan	640 AESS/EN	Joint Strike Fighter, LO IPT
Deborah Shaw	516 AESG	C-17 Systems Group
Kevin Spitzer	577 AESG/YN	Propulsion Systems Squadron, F-119 Engines
Walter Zimmer	577 AESG/YN	Joint Strike Fighter, Engines

This list of POCs was compiled to the best of our ability from various sources. If you find any errors, please let us know (Monitor.Staff@wpafb.af.mil) and we will report them in our Corrections section of the Winter 2006 Monitor. Thank You—Monitor Staff

Feature Topic Deicing/Anti-icing

Deicing

Deicing involves spreading or spraying a liquid/solid deicing agent on already formed ice and collected snow. This application lowers the freezing point of the snow/ice so that it becomes a liquid rather than remaining a solid.

Anti-icing

Anti-icing involves spraying or spreading a liquid or solid deicing agent directly on the pavement or aircraft (liquid deicing agent) before the snow or ice are present, thus lowering the freezing point at which snow/ice bonds to the pavement.

Goal

Deicing and anti-icing procedures have the same goal: to make equipment (aircraft) and road conditions safe for travel. The two processes differ in time of application, amount of application and in some monitoring measures which help determine the time and amounts of application.

Anti-icing generally saves time and money, as well as reduces pollutant discharge. However, these savings are not guaranteed with every anti-icing application. In some specific cases, a savings may not be realized, or anti-icing may make the whole management process cost more. However, these cases are generally the exception, and it is generally accepted that anti-icing is a crucial part of any ice and snow control program.

Source

Lt Brian D. McCarty USAF, Director, Roy T. Willis, Project Manager, Human Systems Center Development Planning Directorate, Technology Assessment, Requirements Analysis, Deicing Final Report, Contract No. F33615-90-D-0652 / 0006, October 23, 1996

Overview of the Air Force Materiel Command (AFMC) Ad Hoc Deicing Working Group

"Empowerment" is a concept that leaders in all organizations, both private and public, struggle to implement. In a time of dwindling resources and organizational changes, how do we empower our people to "do even more with fewer resources"? This article summarizes the formation of one such a group, where a team of professionals are voluntarily addressing the technical challenges associated with aircraft and runway deicing/anti-icing. The Air Force Materiel Command (AFMC) Ad Hoc Deicing Working Group derives its presence and power through voluntary cooperation. However, moving forward, the group needs to overcome the barriers associated with a lack of top level support and resources to execute its long range research & development (R&D) strategy for aircraft and runway deicing/anti-icing.

Background

Aircraft and airfield deicing/anti-icing are operations critical to flight safety for the Department of Defense (DoD) aerospace weapons. Even a small amount of ice on an airframe or airfoil can degrade the aircraft's lifting and control properties. Guidance for defining the deicing requirement for DoD systems is provided in Section D.3.4.4.11 (Ice Protection) of the Aerospace Environmental Management Systems, Joint Service Specification Guide (JSSG) 2009.

For the Air Force, Technical Order (TO) 42C-1-2, "*Anti-Icing, Deicing, and Defrosting of Parked Aircraft*" provides general guidance on aircraft deicing/anti-icing activities. This TO was revised in June 1997 to include the use commercial deicing (Type I, Aerospace Material Specifications (AMS) 1424) and anti-icing fluids (Type II and Type IV, AMS 1428). The change was directed, in part, by AF senior leadership, due to a 1996 Class A mishap involving an engine damaged by ice. However, the use of the commercial fluids, listed in the general series TO must be approved by the Single Manager, prior to use on a specific aircraft.

The Air Force airfield deicing and anti-icing protocols are addressed in Air Force Instruction (AFI)-32-1002, "*Ice and Snow Control*", dated 1 October 1999. The AFI requires that all solid chemicals (except for urea) used on airfields are certified to AMS 1431, *Compound, Solid Deicing/Anti-Icing, Runways and Taxiways* and liquid chemicals (other than isopropyl alcohol and propylene glycol) used on airfields are certified to Society of Automotive Engineers (SAE) AMS 1435, *Fluid, Generic, Deicing/Anti-Icing Runways and Taxiways*. Two approvals are required for use of airfield deicing and anti-icing products. First, chemical agents for airfield deicing/anti-icing must be approved by the installation's Environmental Protection Committee. Next, the base must receive approval from single managers of weapon systems resident at the base. Potassium acetate (certified to AMS 1435), sodium acetate and sodium formate (both certified to AMS 1431) are currently the most commonly used deicing/anti-icing agents used on airfields.

The Clean Water Act (CWA) and its National Pollutant Discharge Elimination System (NPDES) permitting requirements for storm water runoff are the regulatory constraining drivers for deicing requirements for the Air Force's historical pollution prevention needs. These requirements, shown in Figure 1 on page 13, drove the initial R&D effort to find alternative materials and processes for aircraft and runway deicing/anti-icing operations. In-flight deicing remains a separate area covered in the JSSG 2009 and is not considered an environmental problem. Details related to this operational issue were covered at the second AFMC Deicing Workshop (see related article on pages 18 to 23).

Formation of the AFMC Ad Hoc Deicing Working Group

The AFMC Ad Hoc Deicing Working Group formed organically in response to emerging requirements for testing alternative deicing materials and to organizational changes within the Air Force. What started as an informal teaming arrangement between Aeronautical Systems Center, Acquisition Environmental, Safety and Health Division, Pollution Prevention Branch (ASC/ENVV) and the Air Force Research Laboratory, Materials Directorate (AFRL/MLS) eventually expanded to include representatives from several organizations within the Air Force. Later the group teamed with all Service Components as well as the Federal Aviation Administration (FAA) and industry.

In 1997, ASC/ENVV and AFRL/MLS teamed together to address weapon system material compatibility concerns arising from changes in runway deicing products that were implemented due to environmental requirements. Both organizations already had some mission responsibilities for aircraft deicing fluids which would interact with weapon systems. In May 1999, HQ AFMC assigned the Aeronautical Systems Center's Engineering Directorate (ASC/EN) the responsibility of acting as the single face to the Air Mobility Command (AMC) for all operational deicing concerns. ASC/EN later assigned the duty to ASC/ENVV and the role evolved into the single face for all major commands (MAJCOMs). In 2001, a non glycol aircraft deicing fluid technology matured and appeared to be nearing consideration for implementation, which led to coordination with the organization responsible for managing the general series TO for aircraft deicing (TO 42C-1-2). This organization was the Air Force Petroleum Office, Product Engineering Branch (Det 3, WR-ALC/AFTT), who had just been relocated to Wright Patterson AFB after a Base Realignment and Closure (BRAC) realignment involving Kelly AFB. Representatives from the Petroleum Office became more interested in deicing R&D activities, and developed a solid working relationship with ASC/ENVV and AFRL/MLS.

The AFMC Ad Hoc Deicing Working Group expanded significantly when ASC/ENVV led a project to demonstrate an radiant technology in the McKinley Climatic Chamber at Eglin AFB, FL in 2002. Organizations interested in this technology included the Army Corps of Engineers, Navy, FAA and Elmendorf AFB, AK. Representatives from these organizations joined the informal Working Group to prepare for and carry out an objective and thorough demonstration. As all the participants recognized the mutual interest in aircraft and airfield deicing/anti-icing concerns, the working relationships continued after this particular effort concluded.

The Working Group began to conduct weekly teleconferences to discuss ongoing projects, requirements, and concerns. The synergy built at these teleconferences led to the first Deicing Workshop, held in March 2004, and later the formal writing of a charter for the Working Group (see Figures 2a and 2b on pages 14 and 15). The charter was developed in recognition of the group's accomplishments as well as limitations. However, the group is still operating under an unsigned charter with no designated funding line.

continued on page 16

Figure 1. Historical Air Force Deicing Needs Entered Into the Environmental Development Planning (EDP) Database

Need #	914	918	2501	2504
1. Runoff to Storm Water	△	△	△	△
2. Concern with BOD and Toxicity	△	△	△	△
3. Desire Substitute Product	△	△	△	△
4. Responding to NPDES	△	△	△	△
5. Testing Required			△	△
6. Refer to Potential Acetate Substitutes	△	△		
7. Terrestrial and Aquatic Wildlife Impacts	△	△	△	△
8. High Priority	△	△		
9. Medium Priority			△	△

Similarities of Deicing Group Needs

Need Definitions

Need 914: Environmental Improvements to Aircraft Deicing Operations

All aircraft deicing operations at Wright Patterson Air Force Base (WPAFB) utilize Type I propylene glycol. This has been in effect since the winter of 1991-1992 when the use of ethylene glycol was discontinued. Where hanger space is available, aircraft are parked inside and require minimum deicing. For aircraft parked outside (namely transient aircraft) deicing activities take place on the East and West ramps and all runoff drains to the storm sewer system. Glycol-based deicing formulations exert a high biochemical oxygen demand (BOD) on receiving waters and present potentially high toxicity impacts as well. While propylene glycol and BOD are not currently permitted parameters under WPAFB's NPDES permit, degradation of water quality is prohibited. Conversion to propylene glycol has eliminated the potential toxic effects associated with the former use of ethylene glycol. Maximum use of hanger space reduces the number of aircraft requiring deicing. Preliminary blowing/brushing of aircraft reduces the amount of chemical applications required. Nonetheless, a more environmentally benign chemical than propylene glycol is desired.

Need 918: Improvements to Road Deicing Operations

Salt is the most commonly used agent for roadway deicing. Adverse environmental effects are occurring along areas which receive salt. In addition, high levels of salt are observed in adjacent waterways, creating stress on fish and wildlife. Urea is used on some sidewalks. Urea degrades by hydrolysis to ammonia and is subsequently converted to nitrate by nitrifying soil organisms. The acute toxicity of ammonia to aquatic life is relatively high, while nitrates stimulate the eutrophication[1] process. State regulations prohibit the degradation of water quality. A cost effective alternative to salt or urea is needed. Liquid potassium acetate has been suggested as it offers substantially less potential environmental impact. The compound decomposes to potassium and acetate, which exerts a slight BOD as it metabolizes to carbon dioxide and water. The BOD with ammonia and nitrate degradation is eliminated. Utilization of potassium acetate would require acquisition of liquid storage and application systems.

Need 2501: Use of Sodium Formate for the Deicing of Pavements

Examine the use of sodium formate for deicing of pavements to assess its potential use. Sodium formate has a significantly lower oxygen demand than any of the currently used deicing/anti-icing compounds. Unlike the various acetates being used or proposed for use, sodium formate has a neutral pH which reduces corrosion problems. Instead of acetates or urea, sodium formate usage for apron, runway and pavement deicing and anti-icing would greatly reduce the amount of oxygen-demanding compounds released into the waters of the U.S. and may decrease corrosion of metal parts.

Need 2504: Degradation Rates and Products of Deicing Compounds

Provide information regarding degradation rates and products. Many deicing compounds are used for deicing both planes and pavements. Meltwaters carry these compounds into the waters of the U.S. where they exert an oxygen demand and degrade. The intent of the storm water environmental regulation (40 CFR 122-124) is zero discharge of pollutants in storm water to the waters of the U.S. To approach this goal, Best Management Practices (BMPs) must be implemented to minimize the amount of pollutants in storm water. It is difficult to determine if BMPs are working when it is not known what compounds to test for.

Laboratory program information from the FY95 USAF Environment, Safety and Occupational Health Research, Development and Acquisition (ESOH RD&A) Strategic Plan indicates that the product from Work Unit No. S-96-011 Degradation Rates and Products of Deicing Compounds is a Technical Report which will detail the environmental pathways, degradation rates and degradation products for deicer compounds and their additives. Information from the 6.2 Investment Strategy Sheet shows that this product addresses Need 2504 and the results of this effort will be transferred to the Headquarters and base environmental planning functions through Technical Reports and journal articles. Milestones indicate a completion date of June of 1997 (FY95 ESOH RD&A Strategic Plan, S-96-011, pp. 1-3).

[1] Eutrophication is a process whereby water bodies, such as lakes, estuaries, or slow-moving streams receive excess nutrients that stimulate excessive plant growth (algae, periphyton attached algae, and nuisance plants weeds). This enhanced plant growth, often called an algal bloom, reduces dissolved oxygen in the water when dead plant material decomposes and can cause other organisms to die. (http://toxics.usgs.gov/definitions/eutrophication.html)

Source: Lt Brian D. McCarty USAF, Director, Roy T. Willis, Project Manager, Human Systems Center Development Planning Directorate, Technology Assessment, Requirements Analysis, Deicing Final Report, Contract No. F33615-90-D-0652 / 0006, October 23, 1996

Figure 2a. Overview of the AFMC Ad Hoc Deicing Working Group

Authority

The AFMC Ad Hoc Deicing Working Group (AHDWG) is organized under the authority given to the two working group co-chairs:

- The Air Force Petroleum Office (Det 3, WR-ALC/AFTT), under authority given by DoD Standardization Directory 1, is the designated Air Force participating activity for interdepartmental standardization of aircraft deicing fluids (under federal stock class 6850) and is the manager of Air Force aircraft deicing technical orders.
- The Air Force Civil Engineering Support Agency (AFCESA/CEOO), under authority delegated by the Air Force Civil Engineer (HQ USAF/ILE) through AFI 32-1002, is the operational manager for the Air Force Snow and Ice Control Program.

Goals

- Improve mission capability under snow/ice conditions
- Establish/promote regulation, policy, guidance, standards and specifications relating to deicing
- Disseminate information on deicing issues to appropriate organizations
- Identify and prioritize deicing needs for research and development (R&D)
- Leverage resources in support of R&D projects
- Reduce environmental impact of deicing operations
- Coordinate concerns between aircraft and runway/taxiway deicing communities

Figure 2b. Membership/Roles of the AFMC Ad Hoc Deicing Working Group

Member	Role
Air Force Petroleum Office, Product Engineering Branch (Det 3, WR-ALC/AFTT)	AFDWG co-chair for aircraft deicing and Air Force focal point for aircraft fluid specifications and standards, including aircraft deicing fluids.
Air Force Civil Engineering Support Agency, Snow and Ice Control Office (AFCESA/CEOO)	The AFDWG co-chair for airfield deicing and operational manager for Air Force snow and ice control program. In accordance with AFI 32-1002 AFCESA is responsible for: • Recommending procedures for administering the Snow & Ice Control Program for the Air Force • Assisting ILE in developing and testing new deicing technologies • Providing technical assistance to the MAJCOMs and keeps them abreast of new deicing technologies
Aeronautical Systems Center, Engineering Directorate (ASC/EN)	The designated AFMC focal point for technical deicing issues. ASC/EN is responsible for: • Interfacing with weapon system wings/groups/squadrons to identify and define requirements pertaining to deicing • Interfacing with weapon system wings/groups/squadrons to help ensure new deicing materials are compatible with their systems prior to using them • Disseminating pertinent and applicable information to weapon system wings/groups/squadrons
Air Force Research Laboratory, Materials Directorate (AFRL/ML)	In accordance with AFI 32-1002, is responsible for: • Conducting research and development (R&D) on aircraft and airfield deicing/anti-icing agents in support of Weapon System Single Managers and HQ AFCESA • Providing engineering support in the form of consultation and testing on airfield and aircraft deicing and anti-icing agents and their impact on generic weapon system materials • Participating and coordinating with Society of Automotive Engineers (SAE) Committee G-12, Aircraft Ground Deicing, for the purpose of: Integrating of military aircraft requirements into appropriate aircraft and airfield deicing/anti-icing specifications Maintaining awareness of any proposed changes to current aircraft and airfield deicing/anti-icing specifications
3rd Equipment Maintenance Squadron, Elmendorf AFB (3 EMS)	Provides the operational perspective to the working group, representing the single greatest user of ice control products in the Air Force.
Associate Organizations (Non-members):	
US Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CRREL)	Provides expertise as the DoD's only laboratory that addresses the problems and opportunities unique to the world's cold regions.
C-17 System Program Office (ASC/YCES)	Provides Program Office input to the Working Group's initiatives.

Source: AFMC Ad Hoc Deicing Working Group Charter (Draft), dated January 2005

continued from page 12

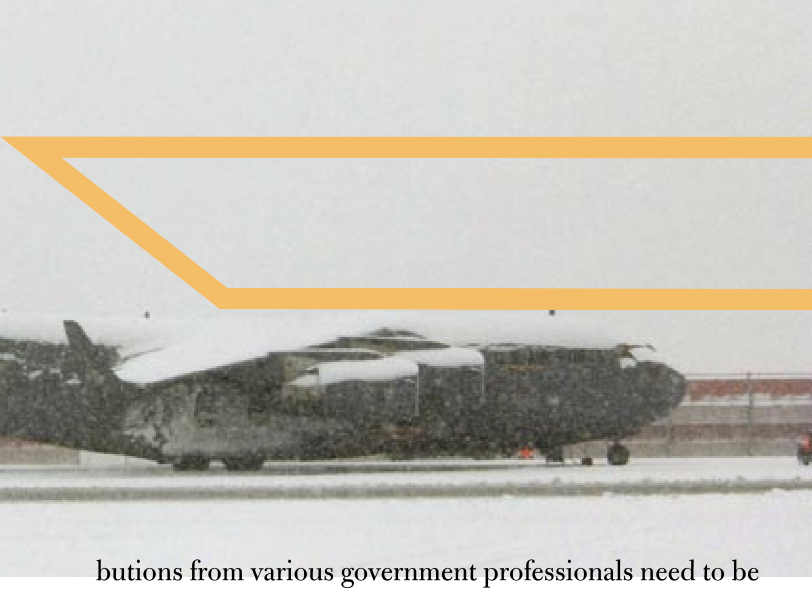
Future Challenges for the AFMC Ad Hoc Deicing Working Group

The AFMC Ad Hoc Deicing Working Group has been highly effective in providing a forum for Air Force personnel to obtain technical information on current and emerging deicing/anti-icing agents. The group has coordinated efforts to identify a variety of alternative fluids and worked with AFRL/MLSC to develop a deicing technology roadmap for current and future material and process substitution projects. Since its inception, the Working Group has expanded its reach to include other government and industry perspectives into their plans and projects. Participation by Working Group members in SAE G-12 Fluid Subcommittee activities is impacting commercial standards. The group's outreach has been enhanced through development of a Deicing Community of Practice (CoP), a virtual web developed after the first deicing workshop held in March 2004.

The power of the AFMC Ad Hoc Deicing Working Group, namely voluntary contribution from its members (see Figure 3 below), is now a limitation for executing its future plans and strategies. Moving forward, the current voluntary contri-

Figure 3. Voluntary Contribution of the AFMC Ad Hoc Deicing Working Group Members

Member	Organization	Voluntary Responsibility
Mary Wyderski	ASC/312 AESG/EN	Designated AFMC focal point for technical requirements
Alexei Lozada-Ruiz	ASC/664 AESS/EN	Provides input on technical concerns that are identified
Dr. Elizabeth Berman	AFRL/MLSC	Provides technical and engineering support to the working group on deicing material issues
Benet Curtis	Det 3 WR-ALC/AFTT	Provides input as owner of T.O. 42C-1-2. Co-Chair for the working group
Thomas Lorman	ASC/ENVV	Provides input on technical concerns that are identified
David Wagner	AFCESA/CEOO	Provides input as owner of AFI 32-1002 and from a civil engineering perspective; Co-Chair for the working group
Jeffery Ransom	3 EMS/MXM	Identifies user/field issues and concerns to MAJCOM level for action
Associate Organization (Non-members)		**Voluntary Responsibility**
CDR Danile Granos	Navy	Provides senior leadership input on Navy's deicing concerns
Major Gary Wright	C-17 Systems Group	Program Office Environmental Representative
Dr. Charles Ryerson	U.S Army CRREL	Provides Army's input to deicing concerns
El Sayed Arafat	Navy	Provides technical input on Navy's deicing concerns
Foy Walker	583 CCBSS/GBMRA	Deicing Ground Support Equipment Representative
Sue Stell	AFCEE/CCR-D	Provides environmental technical support
SMSgt Lawrence Stemberski	HQ AFMC/A4MM	Provides logistics support
Michael Stock	AETC/A4MSE	Provides MAJCOM input on deicing concerns
Don Tarazano	ASC/ENVV	Provides technical support
Juan Mora	AFMC/LG	Provides logistics support on use of deicing materials
Jeffery Walker	Boeing	Provides engineering technical support
James Davila	SAIC	Provides engineering technical support



butions from various government professionals need to be supported with a top-level commitment through a signed charter, and with resources to execute a long range vision. The patch work funding has been a deterrent to efficient, effective and rapid progress in resolving operational deicing concerns.

The AFMC Ad Hoc Deicing Working Group's vision and goals were presented by Mary Wyderski (ASC) and Dr. Elizabeth Berman (AFRL) to the deicing stakeholders at the AFMC Deicing Workshop, held in June 2006. The R&D vision (see Figure 4) is to identify high performance products that meet the warfighter needs, mitigate any material compatibility risk to weapon systems, while reducing the environmental burden. Objectives necessary to execute this vision are centered around: 1) streamlining the approval process for getting new products implemented by revising the draft Deicing Military Test Method Standard (MTMS) into a new Deicing Joint Service Initiative, publishing it as a MIL-STD, and attaching it to the relevant commercial standard; 2) continuing to provide material compatibility data on existing and developing deicing products to aircraft Single Managers; and 3) promoting new technologies that do not pose a risk to weapon systems and reduce the existing environmental burden. The group has also established a long term vision of identifying a single technology to deice aircraft and runways. △

This article was written based on information provided by Don Tarazano (ASC/ENVV-Contractor Science Applications International Corporation) and the following reference sources:

- PRO-ACT, Deicing/Anti-Icing Fact Sheet, July 2002.
- McDonald, Robert "Aircraft Deicing/Anti-icing Fluids and Standards: 2000 Update", Flying Safety, November 2000.
- Thomas, Jeff, "The Iceman Goeth"—Deicing the Plane", Flying Safety, October 2000.

Figure 4. Deicing Research and Development (R&D) Strategy

Vision

Look for single technology to deice runways and aircraft.

Provide high performance runway and aircraft deicing product to meet warfighters' requirements.

Assess/reduce negative impact of deicing chemicals on weapon systems.

Goals and Objectives

Streamline deicing chemical approval process to get available "green" products into use.

- Revise draft Military Test Method Standard (MTMS) for Deicing Materials Compatibility; publish as Mil-Std.

Provide material compatibility data on available/developing deicing products to aircraft managers.

- Materials compatibility testing of LO materials, lubes/ greases, cannon electrical plugs, and HVOF coatings etc.
- Materials compatibility testing of new Foster Miller and Battelle "green" aircraft deicing fluids.
- Develop environmentally friendly runway deicer.

Develop new technologies aimed to reduce environmental impact and/or deleterious effects on weapon systems.

- Develop/transition "green" aircraft deicing fluids (ADFs).
- Develop a less corrosive "green" runway deicing chemical product.
- Transition fixed infrared (IR) aircraft deicing facilities.
- Develop small-scale, cost-effective transportable deicing fluid reclamation system.
- Develop transportable non-chemical aircraft deicing system.

Deicing Workshop Held at Wright Patterson AFB

The Air Force Materiel Command (AFMC) Ad Hoc Deicing Working Group sponsored its second workshop at Wright Patterson AFB, OH from 27– 29 June 2006. Attendees from government and industry provided a breadth and depth of deicing knowledge that facilitated crossfeed and knowledge sharing across the deicing community. This year's workshop covered operational and general deicing/anti-icing issues facing the Air Force, Army, Navy, National Aeronautics and Space Administration (NASA), Canadian Air Force, Federal Aviation Administration (FAA), and industry.

During the first day of the workshop, stakeholders discussed various operational issues both informally and through structured presentations. Robert Giroux (AF Maintenance Chief, Retired) facilitated the general discussion of deicing/anti-icing operational issues. Dr. Charles Ryerson (Army) and Lawrence "Larry" Jenkins (ASC/ENFA) discussed the in-flight deicing challenges for the Army and Air Force, respectively (see Figures 5 and 6 on pages 19 and 20, respectively). For both services, Section D.3.4.4.11 (Ice Protection) of the Aerospace Environmental Management System, Joint Service Specification Guide 2009 requires an Ice Protection System (IPS) to ensure that "the air vehicle and its subsystems shall maintain full flight-critical operation in the icing environment as defined in the air vehicle specification.". Dr. Ryerson presented the Army's design, environmental, operational and political challenges regarding in-flight deicing. Larry Jenkins summarized the requirement, challenge, and systems engineering approach used to address in-flight ice protection with the B-2 weapon system's F118-100 Engine specification and the Predator MQ-1/MQ-9. He presented a technology system for in-flight deicing/anti-icing protection, with operational avoidance as the ultimate driving base behind all activities that take place in the weapon system. At the end of the discussion, Larry Jenkins posed a set of questions to the group, which included, "Where are our cross-cutting targets for in-flight icing protection? Are there synergistic approaches for ground de-ice and in-flight icing protection? What field limitations do we have now that drives us to a pull for technology? What is the near term target in technology based improvements especially looking at Unmanned Air Vehicle (UAV) weapon system technology?"

Mike Sanders, Weapon Systems Support Branch Air Force Petroleum Office (AFPET) provided a presentation on Parked Aircraft Deicing / Anti-icing Specifications, Standards, and Technical Orders (TO). He outlined the requirements under TO 42C-1-2, *Anti-icing, Deicing, and Defrosting of Parked Aircraft* (see Figure 7 on pages 21 and 22) and facilitated discussion on the known corrosion problems associated with the use of runway deicers (potassium acetate, sodium formate, and sodium acetate) that are qualified under Aerospace Material Specification (AMS) 1431 and 1435 as environmentally friendly alternatives to urea. Potassium acetate based runway deicing fluids have caused numerous compatibility problems resulting in

continued on page 23

"I believe the true value of the Deicing Workshops has been the sharing of information for the common good. This year's workshop, as well as the first one held in March 2004, was an eye opening awareness of a broad range of challenges faced by aircraft and runway deicing stakeholders. The workshop focused on environmental impacts, but the warfighter needs remain first priority. Cost and impact to the environment must remain second. All aspects of deicing operations are critical support activities and short sighted decisions can be costly and even disrupt mission capabilities. While improving deicing technologies, for example to minimize impacts to the environment, we must ensure warfighters' performance is not impacted. We learned during this year's workshop that the evidence is in and the attempt to reduce impact to our waterways by replacing the runway deicing chemicals in the mid-1990s, without recognition of the impact on commercial and military weapon systems, are proving to be very costly in corrosive damage to commercial aircraft structures such as hydraulic lines, carbon brake linings, and electrical wires and plugs. Even runway deterioration has been noticed along with corrosion on runway lighting fixtures and support vehicles. Some of this could have been avoided with more comprehensive decision making processes. This had been corrected now, but after the damage was done."

Ms. Mary Wyderski
(ASC/312 AESG/EN), AFMC Ad Hoc Working Group Primary Member

DoD Requirement Driver
Joint Service Specification Guide 2009
Aerospace Environmental Management Systems

D.3.4.4.11 Ice protection.

The air vehicle and its subsystems shall maintain full flight critical operation in the icing environment defined in the air vehicle specification. The air vehicle and its subsystems shall recover a 'full mission capability' within the (TBS 1) time period after exiting icing conditions. An Ice Protection System (IPS) shall be provided as required to meet the above requirements.

a. Unprotected components. Ice accretion on components that cannot or will not be protected shall present (TBS 2) degradation to mission capability and maneuvering performance parameters and shall not present unacceptable safety risk to flight crew or ship-or-ground personnel in all operational phases.

b. Protected components. The IPS designs shall adhere to the (TBS 3) documents for the IPS technology implemented for a particular subsystem or component.

c. IPS detection and controls. If an IPS is required, a manual or automatic (or both) detection system for sensing incipient ice accretion shall be provided and shall enunciate (TBS 4) information to the pilot. A (TBS 5) method for reporting surface ice control performance shall be provided for flight critical and safety-of-flight components.

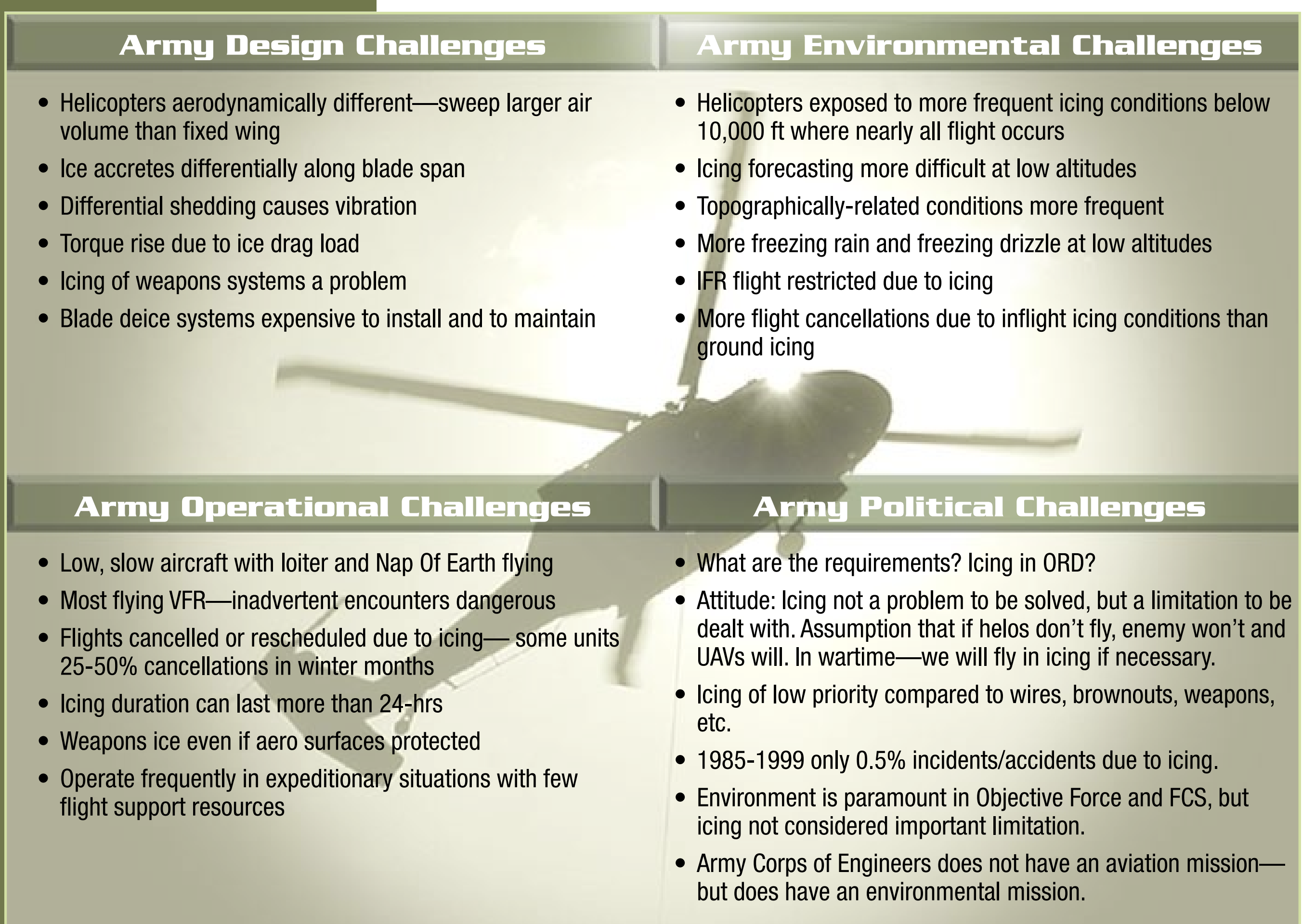


Figure 5. Overview of Army Inflight Icing Challenges

Source: Dr. Charles Ryerson, U.S. Army CRREL

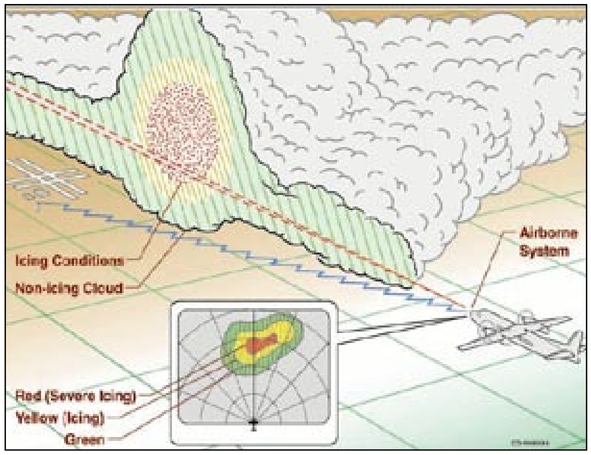
Figure 6. Overview of ASC Inflight Ice Protection Challenge

Source: Larry C. Jenkins, ASC/ENFA

DoD Requirement Driver
Joint Service Specification Guide 2009
Aerospace Environmental Management Systems

D.3.4.4.11 Ice protection.

DoD Operational Challenges



B-2

Requirement	Challenge	SE Approach
• F118-100 Engine Spec. – The engine shall operate satisfactorily under the meteorological conditions shown in Table XI Liquid Water Content: 0.2–2.0 grams per m^3 Mean Effective Drop Diameter: 15 micron–20 micron • The engine de-icing system shall prevent detrimental accumulation of ice in the engine while operating in icing conditions	• Simple Ice FOD challenge • Size and density of ice too severe for the engine • Investigated Ice phobic coating—Field demonstration poor—Coating work adhesion a challenge point	• Operational approaches to meet the challenge minimize the impact on the system design deployed • Develop more rugged and durable turbine blades to handle this requirement challenge and operationally seek out improved flight operations for avoidance

Predator MQ-1/ Reaper MQ-9

Requirement	Challenge	SE Approach
• M Q-9 : Climb through 500 ft of light ice at 19,000-24,000 ft	• Laminar Flow Wing Design • Wet Wing Concept Limited Usage—Operational challenging limitations • Limited ceiling conditions and long loiter or dwell time • Studying Electro-Expulsive Methodology—Army Version	• Operational approaches to meet the challenge minimize the impact on the system design deployed • Simplicity to minimize complexity and assure affordability with speed

Technological Sys. for In-flight De-Ice/Anti-Ice

- De-Ice Boots
- Bleed System Anti Ice
- Ice-phobic Coating
- Electro-Expulsive System—Shedding ice
- Operational Avoidance

Figure 7. Overview of Parked Aircraft Deicing/Anti-Icing Specifications and Standards in TO 42C-1-2

General Series Deicing T.O.

T.O. 42C-1-2

Technical Manual

Anti-Icing, Deicing, and Defrosting of Parked Aircraft

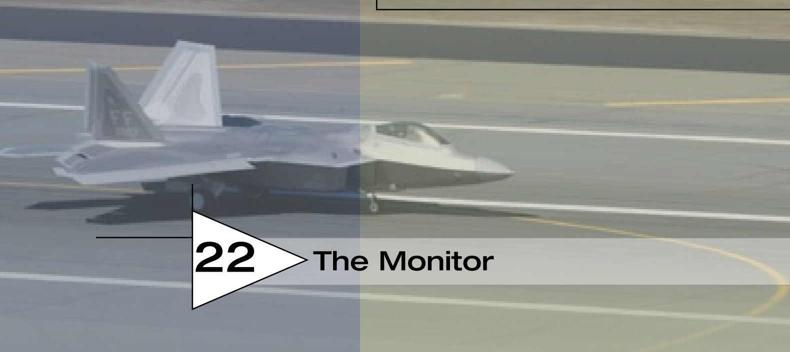
WARNING: This T.O. is incomplete without reference to the Air Force Standards Agency's (AFFSA/XO) Holdover Tables. See Paragraph 7.3.1.1. Step a. Users who rely on printed copies much reproduce and file a copy of the current Holdover Tables with this T.O.

FAA Clean Aircraft Policy	Air Force Policy is consistent with the FAA policy.	AFI 11-202 states: The pilot in command will not take off with ice, snow, or frost adhering to the wings, control surfaces, propellers, engine inlets, or other critical surfaces of the aircraft, unless authorized by the aircraft single manager or flight manual.
T.O. 42C-1-2 Fluids	At present only fluids made of propylene glycol may be purchased due to environmental concerns.	The T.O. identifies and characterizes the SAE fluids presently is use by the Air Force.
	CONUS:	AMS 1424, Type I Newtonian Fluid (viscosity of water) AMS 1428, Type IV Anti-icing Fluid (thickened fluid)
	OCONUS:	AMS 1424, Type I Newtonian Fluid (viscosity of water) AMS 1428, Type II Anti-icing Fluid (thickened fluid) AMS 1428, Type IV Anti-icing Fluid (thickened fluid)
	MIL-A-8243 can still be found in storage as War Reserve Material. The last batches of the product were produced in 2000. The supplies have been shelf life tested on a regular basis. Many of the older batches are being condemned due to product deterioration.	In recent discussions with one of the major manufacturers of AMS 1424 Type I deicing fluid it was stated that the product supplied as MIL-A-8243 is the same formulation as AMS 1424. Only the testing requirements changed when the new specification was created. It follows to reason that the generic chart for Type I fluids in the HOT may be applied to MIL-A-8243 if it is used.
	AMS 1428, Type III Anti-icing Fluid (thickened fluid).	One fluid not listed in the T.O. is a new Type III anti-icing fluid. Although it is a thickened fluid the viscosity is significantly lower than Type II and IV fluids. It has a longer holdover time than Type I fluids but is thin enough that it might be able to be used on aircraft that cannot use Type II and IV anti-icing fluid. Could be used on aircraft designated to use any AMS 1428 fluid. Not aware of any Program Office approval at this time
T.O. 42C-1-2 Fluids-Don'ts	T.O. 42C-1-2 Fluids-Don'ts.	Cross mixing of AMS 1424 fluids from different manufacturer's is not recommended as the fluids are not required to be compatible. If the fluids must be mixed, aim to have less than 10% residual fluid in the tank before refilling. If the residue exceeds 10% contact our office for advice and possible lab analysis. The formation of particulate matter is a common interaction. Never mix Type II/IV fluids with Type I fluids. Any accidental mixture should be disposed of through proper channels.
Refractometers	Hand held refractometers play an important role in the quality control of aircraft deicing fluid.	Refractometers can be used to determine if an undiluted Type I fluid can be returned to storage at the end of the deicing season. Using the Tables in Appendix B you can determine if the product is pure. Be sure to check the accuracy of the refractometer against your results. Visually inspect the product for contamination prior to returning it to stock. This saves money by avoiding paying disposal costs, and no product is wasted. There are 2 charts for converting BRIX scale refractometers readings to Refractive Index (RI).

Figure 7. Overview of Parked Aircraft Deicing/Anti-Icing Specifications and Standards in TO 42C-1-2 (continued)

T.O. 42C-1-2 Procedures	The following procedures are outlined in the T.O.	One-step deicing Two-step deicing One-step anti-icing General areas to be deiced with a Type I fluid Critical area to be deiced/anti-iced
	Program Manager T.O. Guidance (Aircraft Specific).	Aircraft control settings Essential areas to be deiced/anti-iced Critical areas not to be deiced/anti-iced (wheels, exhaust, thrust reversers, engines, APU, brakes, Radomes, and sensor openings)
What makes Up Type IV Anti-icing Fluids?	Anti-icing fluids are made up of the following ingredients.	Propylene glycol, Water, Corrosion Inhibitors, Surfactant (soap), Anti-foaming agent, Dye Super absorbent (water absorbing) polymer (SAP) (This polymer is similar to what is found in disposable diapers)
How do Type IV Fluids Work?	Anti-icing fluids provide extended protection during active precipitation. Type IV fluids are designed for large transport aircraft with takeoff rotational speeds that generally exceed 100 to 110 knots and have a takeoff ground roll time of not less than 23 seconds.	The SAP binds to the water in the snow, sleet, or rain which prevents it from diluting the propylene glycol in the fluid. The SAP is eventually overwhelmed by the moisture and the fluid will fail to provide protection. The Holdover Tables provide guidance as to how long you can expect that protection to last.
Nozzle Samples	5.2.6 Annual Validation of Deicing Equipment for AMS 1428, Type II/IV.	Nozzle samples of Type IV fluids need to be taken once a year to ensure that the pump is not degrading the viscosity of the product excessively.
	Nozzle Samples.	The trucks used to apply Type IV anti-icing fluids need to be checked to ensure that the pumps are not damaging the fluid. Anti-icing pumps are diaphragm pumps which move the product without lowering the viscosity (shearing) of the fluid significantly. A fluid with a low viscosity could lead to decreased protection and shorter holdover times. Maintenance issues, such as the pump wearing out, or a nozzle deformity, can lead to excessive fluid shearing.
Hold Over Tables (HOT)	The Air Force Flight Standards Agency must approve the FAA Holdover Tables each year authorizing the Air Force to use of the FAA Tables. The AF approved tables can be found at https://private.andrews.amc.af.mil/AFFSA/A3O/A3Of/xof_weather.htm.	For Type II and IV fluids the FAA Holdover Tables lists how long you can expect a specific fluid to provide protection under given temperatures and conditions. If you are unsure of what brand of fluid is being applied to the aircraft there is a generic chart that should be used. It is based upon the fluid that provides the least protection. Only fluids that are qualified and up to date on their aerodynamic and chemical testing are listed by name in the HOT. The FAA Holdover Tables provide information on how long the aircraft will be protected under various temperatures and forms of precipitation. For Type I fluids there is one generic Table which covers all Type I fluids. For Anti-icing fluids there is one generic Table for each type of fluid. Also there are Tables for each qualified fluid by name and manufacturer. The generic Tables should be used when the manufacturer of the product is not known.

Source: Mike Sanders, Weapon Systems Support Branch, AF Petroleum Office



Deicing Conference, continued from page 18

failure of, carbon brake linings, electrical switches and wire harnesses due to high corrosivity and conductivity. Although, this problem may be mitigated with proper maintenance practices, the Air Force is asking the Society of Automotive Engineers (SAE) Committee G-12 (Aircraft Ground Deicing) to add a conductivity requirement to the specification to reduce the number of corrosion problems for Air Force weapon systems. FAA has already issued increased inspections of specific aircraft driven by evidence of effects caused by potassium acetate runway deicing chemicals.

Mike Sanders discussed the use of Infrared (IR) technology at some commercial airports and stated that the Air Force would like to use this technology. However, its present design has not been accepted for operational use. Presently, the Air Mobility Command has shown interest and asked the C-17 program to do a preliminary evaluation. Also, the personnel at Fort Drum, New York and Spangdahlem AB, Germany are considering this technology as an alternative to fluid deicers. The fixed commercial facilities have demonstrated a general cost savings over fluids. Mike Sanders, also discussed a new glycol-free formulation of AMS 1424 fluid that may be able to address the unique deicing requirements for helicopter blades in the future.

The two general session days of the workshop were organized to crossfeed information on various deicing programs, policies, technologies, and projects across DoD, NASA, FAA, Canadian Air Force and industry (see Figure 8 on page 24). Subject matter experts provided briefings on various general aircraft and runway deicing/anti-icing issues with a tie to environmental concerns. The first general session day covered briefings on various deicing programs, deicing fluids, deicing equipment and supply/logistics issues. The second general session day included updates from industry on current deicing initiatives and an overview of the Army, Navy, and Canadian Air Force Deicing Programs.

During the general session days of the workshop, it became clear that aircraft deicing fluids containing propylene glycol are being continually subjected to environmental, operational, and cost constraints. Several of the workshop speakers presented the IR technology, which is used commercially, as a possible future deicing system for DoD. Currently, the Air Force has contracted, through a Small Business Innovative Research (SBIR) project, the development of a transportable IR system for consideration. The Air Force Institute for Operational Health (AFIOH) recommends, that in conjunction with the SBIR project, the Air Force investigate and build new designs for mobile and fixed IR deicing systems.

A concern that was presented during both the operational and general session days was related to aircraft material compatibility (e.g., corrosion) associated with newer runway icing/de-icing materials that are used due to increasing environmental constraints. The current initiatives to solve this problem were presented by both government and industry participants. A separate article on pages 25 to 27 further discusses this critical issue and the current effort for mitigation.

If you would like a copy of the briefings presented at the workshop, please contact Mary Wyderski at DSN 786-6178 or visit the Deicing Community of Practice (CoP) at https://afkm.wpafb.af.mil/ASPs/CoP/TranCoP.asp?Filter=OO-EN-KS-01. △

This article was written from the briefings presented at the AFMC Deicing Workshop and input from Don Tarazano (ASC/ENVV Contractor—Science Applications International Corporation)."

Figure 8. AFMC Deicing Workshop Agenda

Day	Topic	Presenter(s)
Operational Day Tuesday, June 27, 2006	**Operational Forum Welcome**	Keynote Speaker: Lt Col Charles Ward (AFRL/ML)
	Status of 2004 Deicing Workshop	Mary Wyderski (ASC)
	Introduction to Operational Day	Robert Giroux (AF Maintenance Chief, Retired)
	Parked Aircraft Deicing / Anti-Icing Discussion	Mike Sanders (AFPET)
	Runway Deicing / Anti-Icing Discussion	Robert Giroux (AF Maintenance Chief, Retired)
	In-flight Icing / Deicing Discussion	Lawrence Jenkins (ASC), Dr. Charles Ryerson (Army), Dr. Judy Van Zante (NASA)
General Session Day 1 Wednesday, June 28, 2006	**Administrative Remarks, Welcome, Review Action Items from Operational Day**	Mary Wyderski (ASC)
	Keynote Speaker	Col Robert Hunter (445 MXG/CC)
	Guest Speaker	George Waskosky (Col, Retired)
	Overview of AFMC Deicing Program	Mary Wyderski (ASC)
	SAE Organization	Ed Pugacz (FAA), Dr. Charles Ryerson (Army)
	Deicing Specs and Standards	Mike Sanders (AFPET)
	C-17 Deicing	Jeff Walker (Boeing)
	Lubricants / Anti-Icing Fluids	Angela Campo (AFRL)
	Deicing Fluid Recycling	Teresa Lush (Inland Group)
	Human Eye vs GIDS	Ed Pugacz (FAA)
	Supply and Logistics	Mike Sanders (AFPET)
	Deicing Equipment	Robert Giroux (AF Maintenance Chief, Retired)
General Session Day 2 Thursday, June 29, 2006	**Administrative Remarks, Welcome, Review of Action Items from General Session Day 1**	Mary Wyderski (ASC)
	Continental Airlines Experiences	Ed Duncan (Continental Airlines)
	NDCEE Joint Service Initiative	Leanne Debias (CTC)
	Infrared Deicing	George Waskosky (Col, Retired)
	Deicing Training	Dr. Judy Van Zante (NASA)
	Environmental Challenges	Ann Caudle (Tinker AFB)
	Deicing Equipment	Rick Smith (Global Ground Support)
	Canadian Air Force Deicing Program	Major Wells, Capt McKinnon (Canadian Air Force)
	Navy Deicing Program	Commander Granados (Navy)
	Army Deicing Program	Dr. Charles Ryerson (Army)
	Closing Remarks, Deicing Workshop Wrap-Up Forum Adjourns	Mary Wyderski (ASC)

How Will Deicing Materials Impact Your Aircraft?

It is well known that environmental issues influence Air Force weapon systems production, maintenance and operations. In some cases these concerns are material and chemical usage related. One approach to mitigating the impact in using environmentally regulated materials is to find a more benign material alternative that meets the performance of the original material, but reduces the environmental impact or risk and does so in a cost effective manner.

Satisfaction of runway deicing performance requirements does not ensure material compatibility with weapon systems or sub-systems when the deicing material may come in contact with them. It is critical that deicing materials are tested for compatibility with many unique materials that are well beyond the breadth of commercial specifications. Not too many commercial aircraft have electronic-countermeasure pods that hang low on their wings or low observable (LO) materials and coatings on their exterior surfaces.

The replacement of urea and glycols with potassium acetate, sodium acetate, and sodium formate for runway deicing has highlighted the need for thorough materials compatibility testing. Runway deicing products are qualified to Society of Automotive Engineers (SAE) Aerospace Material Specification (AMS) 1431 and 1435, specifications which define performance requirements for commercial runway deicers but do not contain comprehensive material compatibility tests required to meet Air Force needs that go beyond the commercial specifications.

After the Air Force began using alternative runway products, weapon systems and support engineers became concerned over possible negative interactions between the deicing materials and aircraft components. The Air Force Research Laboratory (AFRL) conducted a study to evaluate exposure of metals, composites, infrared windows, elastomers and sealants, electrical wiring, and carbon-carbon brakes to the new deicing materials. The study, documented in AFRL-ML-WP-TR-1999-4040, Testing of Aircraft Runway Ice Control Products, indicated a few undesirable interactions for some of the deicing materials, the most notable being greater damage to wires in arc track propagation resistance testing and a detrimental effect on carbon-carbon material oxidation rates at 1,300°F (simulated operational temperatures). Subsequent studies have evaluated additional deicing chemicals, and interactions with more aircraft materials (low observable materials, lubricants and greases, cannon electrical plug pins, and high velocity oxygen fuel (HVOF) spray coatings), but limited funding has not allowed completion of these efforts.

(At the same time new commercial aviation runway products have been and still are constantly under development, so the extent of products requiring compatibility testing prior to Air Force use is expanding).

In the field, incompatibility between weapon system components and deicing chemicals impact maintenance and cost significantly, as illustrated by a few examples.

Continental Airlines has attributed several problem areas to exposure to fluid or pelletized runway deicers. Known impacts include corrosion of cadmium plating on some 737's and EMB-145 aircraft, aluminum corrosion in specific areas (main wheel well and wing hydraulic lines) on 737's, and catalytic oxidization of carbon brake materials on 757-300, 767-200, and 777-200 aircraft. There are also some suspected issues with corrosion in other locations and with arching within some wire bundles.

Continental Airlines developed cost impact estimates (see Figure 9 on page 27) for additional inspections, maintenance and component and equipment replacement due to the use of current runway deicers.

KLM airlines, in a presentation on carbon brake oxidation, indicated that higher levels of catalytic oxidation occur with higher concentrations of suitable contaminants to act as catalysts (such as aircraft deicers, runway deicers and cleaning agents containing potassium, sodium or calcium). In a model using 60 aircraft with about 750 installed carbon brakes, it was calculated that 75 premature brake removals due to catalytic oxidation would result in approximately *3* million dollars per year in materials costs alone. Also, beyond the monetary cost, KLM indicated experience with such undesirable events as Brake Overheat alerts and the collapse of brakes with possible engine ingestion of debris.

Boeing Corporation, manufacturer of the Air Force C-17, has also reported premature brake lining failures and high failure rates of forward facing infrared (IR) laser subsystems. Brake lining deterioration has raised concerns over both ingestion into the engines and brake lining replacement costs, while system safety concerns for the IR laser subsystem has prompted an expensive re-design to preclude acetate type deicing fluid entrapment.

While inspection or washing procedures can be implemented to assuage some of the impact of exposure to deicing chemicals, the ideal path to risk reduction would be verification of material compatibility prior to implementation of any new chemicals or technologies. One route to facilitating the evaluation of new deicing technologies while ensuring the safety of systems and equipment encountering those technologies is the development of a single materials testing standard.

When the Department of Defense (DoD) decided to move away from Military Specifications and Standards and embrace commercial standards, it was recognized within Aeronautical Systems Center (ASC) that the commercial standards for runway and aircraft deicing material compatibility testing would be inadequate to meet the Air Force requirements. ASC and AFRL decided to create an amendment to the commercial deicing standards, which is referred to as the Deicing Military Test Method Standard (MTMS). Engineers from the two organizations first started working toward the development of this standard in 2003, with the intent of attaching it to SAE AMS commercial deicing material specifications to ensure vendors also test for unique Air Force materials.

The MTMS built on the testing procedures for the range of materials utilized in recent deicer materials compatibility studies, addressing metals, composites, infrared windows, elastomers and sealants, electrical wiring, carbon-carbon brakes, low observable materials, lubricants and greases, cannon electrical plug pins, and HVOF coatings. (Evaluation of interactions involving more unusual or exotic weapon system specific materials will be the responsibility of the individual weapon systems for material compatibility testing).

The strategy of a test standard as an amendment to the commercial specifications evolved into a DoD project to include Army and Navy unique deicing material compatibility test requirements, and over the past year efforts have been directed toward a Joint Service Aircraft and Runway Deicing Test Protocol. This document will be completed in August 2007 and will greatly improve procedures that preclude the implementation of technologies that address one set of cost or risk issues but introduce other significant concerns. Hopefully the test protocol will be attached to the commercial deicing material specifications. △

Figure 9. Runway Deicing Fluid (RDF) Problems Observed at Airlines

Source: E. Duncan, CO Aircraft Systems Engineering

Cost Estimates:

This survey statement lists specific known areas of damage and their estimated associate costs at present, such as the following rough estimates for an airline having the size, fleet mix, and general route structure of CO:

Areas of Damage	Cost Estimate
737-NG MWW Cd connector corrosion inspection	$150,000 (US) annually, or $2.2 million PV (present value, assuming 7% discount rate)
737-CL rear spar WB mod & replacement	$1.3 million over next 4 years
737-CL & -NG LG wash & CIC application	$150,000 annually, or $2.2 million PV
Carbon brake reduced life & revenue loss from MEL weight restriction	Rough estimate ranging from $200,000 to $500,000 annually, or $2.9 to $7.2 million PV
767-200 & -400 power feeder cable connector and other connector (all fleets) corrosion, including flight delay and aircraft out-of-service costs	Rough estimate ranging from $100,000 to $300,000 annually, or $1.5 to $4.3 million PV
GSE damage & premature replacement at hub stations	$100,000 to $1 million annually, or $1.5 to $14.3 million PV
Total cost of this initial summary	From $1.0 to $2.4 million annually, or $11.6 to $31.5 million PV per airline
vs. Higher cost to airport of switch to BX36 (e.g.), etc.	From $150,000 to $900,000 annually, or $2.2 to $12.9 million PV (assuming 50,000 to 300,000 gal of fluid used per winter season), to benefit all airlines at that airport

Shared Results:

The results of this survey might be shared with other airlines, in the hope that they will make the same effort and thereby create industry impetus for airport authority purchase and use of less corrosive runway fluids and solids.

Continental Airlines

Information Crossfeed

The Propulsion Environmental Working Group (PEWG) Hosts Meeting at Cherry Point Naval Air Station

The Propulsion Environmental Working Group (PEWG) held its meeting in New Bern, NC from 7-10 August 2006. The PEWG is an industry–government group created to address propulsion related environmental concerns through use of advanced manufacturing and repair technologies that improve military product and system readiness, affordability, and environmental security.

This year's PEWG meeting was co-sponsored by the Naval Air Depot (NADEP), Cherry Point, NC, which is the primary Navy depot for rotary wing and vertical short take-off and landing (VSTOL) aircraft. The depot supports the H-53, H-46 helicopters and the AV-8B Harrier aircraft and its workload includes overhaul of the T64, T58, F402 and T700 engines. NADEP, Cherry Point has been designated as a Vertical Lift Center of Excellence (VLCOE). The VLCOE was established through a FY04 DoD appropriations bill. A Congressional directive mandated the Institute of Aeronautical Technology (IAT) serve as a partner with VLCOE. The IAT, at the Havelock NC campus of Craven Community College, provides specialized training in aviation maintenance.

The theme of this PEWG meeting, for the 120 government and industry participants, was to collaborate and cooperate on engine related environmental issues in order to make a difference for the armed forces. The conference ran concurrent technology interchange sessions on the first day, followed by three plenary session days covering a broad range of engine related issues across DoD and industry (see Figure 10 on page 30 and 31). Topics ranging from emerging regulations, requirements development, alternative funding sources, sustainment challenges, weapon systems lessons learned, and technology/project updates. The meeting leaders challenged the participants to "think outside the box" while concentrating on understanding the specific details of projects and technologies selected for technology insertion. As a highlight to the meeting, the NADEP, Cherry Point also organized a tour of the depot for the participants to get an understanding of the maintenance processes at the facility.

The technical interchange on the first day of the conference included three concurrent sessions on Laser Freeform Manufacturing and Repair, Advanced Coating Technology, and General Propulsion Technologies. A summary of the technical interchange during these three concurrent sessions was provided during the plenary sessions that ran for the next three days of the conference.

Introductions and welcoming remarks to the plenary session were provided by James "Mickey" Conklin, PEWG Program Executive and Col. J. Mark Reed, Commanding Officer of

Naval Air Depot Cherry Point. Colonel William Simpson PEWG Chair, Deputy Director of Propulsion OC-ALC/LR provided an overview on the sustainment challenges related an aging fleet, such as the KC-135 tanker, which will fly until 2040. He stated that the forces need technical solutions and process improvement to maintain service life. He applauded the PEWG's service to the warfighters in its efforts to find and implement solutions and improvements.

The plenary session opened with a presentation by John Hoover, Director of the VLCOE based at NADEP Cherry Point. The vision for the VLCOE is to set the standard for high quality and cost-effective long-term sustainment repair for all vertical lift aircraft within the DoD. The center's primary focus areas include repair and manufacture of emergency parts, vertical lift work force training, and long term sustainment of deployed vertical lift fleet aircraft. In another briefing, Robert Kestler, NADEP, Cherry Point discussed process development and needs at NADEP. He provided an overview of some of the green technologies being inserted at the depot and identified opportunities for partnering, based on future plans for technology insertion. Robert King, Concurrent Technologies Inc. summarized the efforts at NADEP, Cherry Point to mitigate exposure to hexavalent chromium through engineering controls, medical screening, and modifying production process, as needed, to meet the new standard. NADEP, Cherry Point has also developed a scientific basis for modified techniques to reduce the extent of engineering controls required.

Presentations given by Air Force personnel during the plenary sessions covered a range of topics including an overview of the TF33 engine for the B-52 weapon system, the weapon system pollution prevention program at Tinker AFB, weapon system disposal process at Aerospace Maintenance and Regeneration Center (AMARC), the Depot Technology Modernization Program, the propulsion technology office, lean cell trivalent chrome project, and Human System Integration (HSI) implications through the example of the T800 engine.

Some forward thinking presentations included funding opportunities for future projects through the Defense Acquisition Challenge Program (DACP) and the Foreign Comparative Testing (FCT) Program, use of Helium 3, a non-pollution future energy sources, and emerging regulations that will impact the aerospace industry, with particular emphasis given to the impact on the engine community.

The thought provoking ideas and the technical interchange on the current and future material and process substitution efforts were greatly appreciated by both the government and industry participants. New start opportunities and continued project resolutions were introduced in several areas, including advanced spray and laser deposition technologies, alternatives to nickel and chrome bath plating, superalloy reclamation, and laser shock peening for component life extension. In conclusion, there was a general consensus that the PEWG has set an example for effective partnering among military buyers and maintainers, industry, and the science & technology community to discover, prove, and insert technologies that effectively solve engine related problems for our warfighters!

The PEWG Management Team, Mickey Conklin , Bob Bondaruk, Rick Craddock, and Chuck Alford extends special thanks Robert Kestler, NADEP Cherry Point for hosting and coordinating this meeting. If you would like more information about the PEWG or explore a future partnering opportunity, please visit the PEWG website at http://www.pewg.com.

Figure 10. Presentations Given at the 2006 PEWG Meeting

	Topic	Presenter(s)
Monday August 7, 2006	**Fundamentals of Laser Technology**	Mike Lander, General Dynamics Information Technology
	Laser Additive Manufacturing as a Viable Repair Process	Steve Roy, Flight Support, Inc.: Paul Story
	Laser Additive Manufacturing	Dr. Lijue Xue, National Research Council—Canada
	Nano Composite Powders as Laser Feed-stock	Dr. Andy Sherman, Powdermet
	Reclaimed Assets as a Laser Feedstock	Harland Graime, Metals Management Aero-space
	Laser Equipment as used at Flight Support Inc. and others	Dr. Walter Haimerl, TRUMPF Laser Technology Center
	The LENS Process	Dr. Richard Grylls, Optomec
	EB Freeform Fabrication	Robert Hafley, NASA Langley
	Laser Flat Wire Deposition—Low Heat Input Methodology	Joshua Rabinovich, H&R Technology Inc
	EB Free Form Fabrication Technology Update	Robert Salo, Sciaky, Inc.
	Transitioning Lube Oil Systems to Condi-tion Based Maintenance	Gary Rosenberg, Pall Corp
	Laser Shock Peening	Richard Tenaglia, LSP Technologies Inc.
	Advances in Friction Stir Welding and Processing	William J. Arbegast, Director, Advanced Materials Processing and Joining Laboratory, South Dakota School of Mines and Technology, Rapid City SD
	Electro Spark Deposition (ESD)	Norma Price & Larry McCarty, Advanced Surfaces and Processes, Inc.
	Cleanup and Remediation Test Results for TERRACAP and Aqua N-CAP on Tinker AFB	Bill Johnson, RTA Systems, Inc.
	SBIR Phase II Project Update	Dr. Gennady Yumshtyk, Advanced Global Services
	Fundamentals of Cold Spray	Christian Moreau, NRC-IMI
	Cold Spray Application Development at the US Army Research Laboratory	Dr. Andrew Davis
	New Carbide Coating Powder Developments	Dave Hawley, Sulzer Metco
	CERAL 3450, an Environmentally Friendly Aluminum Ceramic Coating	Bruce Bodger and Max Morant, DemVal
	Nano Phosphorous Cobalt Plating	Jonathan McCrae, Integran
	Axial III High Energy Plasma System	Alan Burgess, Northwest Mettech Corp.
Tuesday August 8, 2006	**Opening Presentations**	
	Call to Order and Administrative Remarks	James "Mickey" Conklin, PEWG Program Executive
	Welcoming Remarks	Col. J. Mark Reed, Commanding Officer of Naval Air Depot Cherry Point
	Sustainment	Colonel William Simpson, PEWG Chair, Deputy Director of Propulsion OC-ALC/LR
	PEWG Opening—Propulsion Mission	Timothy Dues, Deputy Director Logistics, Headquarters AFMC/ A4

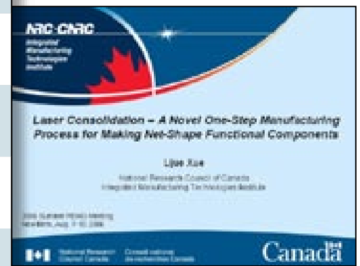


Figure 10. Presentations Given at the 2006 PEWG Meeting (continued)

2004 NASA Speaker of the Year

Wednesday
August 9, 2006

Thursday
August 10, 2006

Topic	Presenter(s)
Vertical Lift Center of Excellence (VL-COE)—The Why and the How	John Hoover, Director, Vertical Lift Center of Excellence (VLCOE)— Program Manager
Defense Acquisition Challenge Program (DACP) & Foreign Comparative Testing (FCT) Program updates	Major Dave Buchanan, SAF/AQP
Aerospace Environmental Regulations	Dave Shanks, Boeing, St Louis
Helium 3, a Non-polluting Future Energy Source Found Abundantly on the Moon	Mr. Donner Grigsby
B52 Weapon System Overview (TF33 Engine)	Rafael Garcia, Deputy Director 327th Bomber and Cruise Missile Sustainment Group/DC, Tinker AFB
LENS Projects at Corpus Christi Army Depot and Anniston Army Depot	Dr. Richard Grylls, Optomec
Weapon System Pollution Prevention (WSP2)— Where We Are!	Bede Ley, Weapon System P2 Program Manager 72ABG/CEV Tinker AFB
Environmental Security Technology Certification Program Review	Charles Pellerin, SERDP & ESTCP Program Offices
Weapons Systems Disposal	Sam Malone, AMARC/CA: and Robert Foley, AMARC/ MAW
Meeting with Industry	Bill Coppedge, 76 PMXG, Tinker AFB
"Integration"—The Future of DMD Manufacturing	Paul Story, Flight Support, Inc.
448th CSW Mission Brief	Dr. Wayne Jones, 448 Combat Sustainment Wing/CN
Navy Repair Development (Reptech)	Dr. Douglas Wolfe, Penn State U
Mining the Skies	Bob Bondaruk, PEWG Program Manager
Depot Technology Modernization Program (DTMP) Update	Steven Austin, HQ AFMC/A4 (CTC Inc.)
Luncheon Speaker	Scott Bergren (MGen, USAF Ret) Senior VP AF Operations General Dynamics IT, Dayton OH
Propulsion-Safety and Affordable Readiness and the Propulsion Technology Office	Walter Zimmer, ASC/577th Aerosystems Group
Review of Day 1—Laser Free Form MRO Technologies	Jeff Catron & Bruce Bodger
Review of Day 1—Coatings Technologies	Bill Coppedge & John Sauer
Lean Cell Trivalent Chrome Project	Glen Graham, 76 PMXG/MXPPE
Nanophosphorous Cobalt Coating	Jonathan McCrae, Integran Corp
Process Development & Needs NADEP Cherry Point	Robert Kestler, NADEP Cherry Point
Environmental Impacts: Lessons Learned for the 21st Century	Mike Rudy, Green Hornet Environmental Program Manager
OSHA Hexavalent Chromium Exposure Mitigation	Robert King, Concurrent Technologies Corporation
HSI and Environmental Implications	Adrian O. Salinas, HSI CONOPS Div./Chair
Closure of HVOF Project	Tim Terhune, OC-ALC/448 CSW
Session 3: General Technologies Recap	Mickey Conklin, PEWG Executive; Chuck Alford; PEWG Management
"Integration"—The Future of DMD Manufacturing	Paul Story, Flight Support, Inc.

F-22 Environmental & Health Working Group (E&HWG) Meeting Held at Tyndall AFB

The F-22 Environmental & Health Working Group (E&HWG) held its 25th meeting on 20-21 June 2006 at Tyndall AFB, FL. Ron Hull, 325 MXG Environmental Coordinator, Tyndall AFB contributed greatly to the success of this meeting through his hard work and coordination as meeting host. Ron led an informative tour of the F-22 operations, briefed on Tyndall AFB pollution prevention innovations, and ensured that the base F-22 maintainers participated in the meeting, which greatly enhanced the sessions.

Over 32 attendees supported active exchange discussions of F-22 environmental and health issues. The broad stakeholder representation included the following: F-22 System Program Office; F-22 ESOH reps from five F-22 Air Force bases, including Edwards AFB's Combined Test Facility, Tyndall AFB, Langley AFB, Hill AFB, and Holloman AFB; additional Tyndall AFB representatives (Maintainers, Supply and Facilities); Headquarters Air Education and Training Command (HQ AETC); Headquarters Air Combat Command (HQ ACC), Air Force Institute of Occupational Health (AFIOH); Air Force Research Laboratory (AFRL), Aeronautical Systems Center, Acquisition Environmental, Safety, and Health Division, Pollution Prevention Branch (ASC/ENVV); Secretary of the Air Force for Acquisition, Science, Engineering, and Technology (SAF/AQRE); F-22 Contractors (Lockheed Martin Aeronautics Company and Boeing); and various vendors. The attendance of F-35 representatives from ASC, NAVAIR, and Lockheed Martin Aeronautics, followed a joint F-22 / F-35 E&HWG held last year, and preceded the F-22 attendance of the Sept 06 F-35 E&HWG.

Full F-22 Environmental & Health Working Group

Thank you appreciation given to Ted Grady for helping set original direction for F-22 HazMat Program, from Arline Denny

Thank you appreciation given to Jared Scott, outgoing F-22 Systems Program Office E&HWG Manager

The F-22 E&HWG presentations covered a broad range of environmental and health issues. The presentations included input from the flight line operators and lessons learned from the Major Command (MAJCOM), depot, and test facilities. ESOH representatives from five F-22 Air Force bases presented environmental and health monitoring data and lessons learned. Technical presentations on current projects were given by Lockheed Martin and Boeing, and by vendors. Additional topics included Tyndall AFB pollution prevention innovations, including silver recycling; advanced composite material demilitarization and reuse, presaturated solvent wipes, composite mishap response, ESH emerging regulations, Attenuating Custom Communications Earpiece System (ACCES TM) & Helmet Mounted ANR, Natural Infrastructure Management applicability to Systems Acquisition Process, and Weapon System ESOH Management / DoDI Changes. The F-22 E&HWG's excellent attendance and active participation ensured the effective crossfeed of information among stakeholders.

The meeting concluded with a special "thank you" to Ted Grady, ASC/ENVV Branch Chief, for helping to set the original direction for the F-22 Hazardous Materials Program and to Jared Scott (ASC), the outgoing F-22 Systems Program Office E&HWG Manager. △

The information in this article was provided by Arline Denny, Lockheed Martin Aeronautics.

Updates on Aeronautical Systems Center, Acquisition Environmental, Safety, and Health Division (ASC/ENV) Pollution Prevention Projects

Aeronautical Systems Center, Acquisition Environmental, Safety, and Health Division (ASCENV) funds and executes pollution prevention (P2) projects at the government owned contractor operated (GOCOs) facilities and in support of the top requirements of ASC's Program Offices. Pages 34-38 present five ongoing projects, in a Summary Sheet format, that are currently being executed.

There is an ongoing initiative, through the Pollution Prevention Branch (ASC/ENVV), to track all current and historical ASC P2 projects in the Summary Sheet format. The goal of this effort is to provide information relevant to completed and ongoing ASC P2 projects to assist in identifying proven technologies that have been developed/applied by others, and to avoid duplication of previous efforts. The data captured in the Summary Sheets will assist ASC/ENVV track a project well beyond execution to document implementation results and capture cost savings. The Summary Sheets have been designed in a familiar format, so as to reduce the time required for Project Managers to update the information.

The effort to populate the Summary Sheets and gather other project related information is currently underway. This information will be housed on ASC/ENVV ESOH Solutions Reporting Tool CoP https://afkm.wpafb.af.mil/ASPs/CoP/ClosedCoP.asp?Filter=OO-AQ-AS-21at a future date. If you would like more information about this initiative, please contact Frank Brown at Frank.Brown@wpafb.af.mil. △

Laser-based Composite Mold Cleaning

ACHA04PV11 / ACHA05PV11
FY 2004/2005

Project Information	WS, Ongoing
Chemical Being Replaced (pollutants being reduced)	MEK, Isobutyl Acetate, Toluene, Propylene Glycol Methyl Ether (PT1002 mold cleaner)
Compliance Driver	Clean Air Act (CAA), Resource Conservation Recovery Act (RCRA)
Thrust Area	Other/Miscellaneous
Alternatives Being Addressed	Handheld Laser
Date Implemented	To Be Determined
Recurring Benefits	To Be Determined
Success Category	To Be Determined

Project Description

The weapon system affected by this project is Air Superiority Munitions. This project provides for the implementation of a laser based capability for cleaning composite molds in the Bldg 814 Paints & Composites Area. This will eliminate the use of Hazardous Air Pollutants (HAPs), Volatile Organic Compounds (VOCs), Sara 313 reportable solvents and Hazardous Waste disposal as found in the existing PT-1000 mold cleaning agent. An Nd-YAG or diode laser based portable cleaning process will be procured and implemented that will eliminate Hazardous Wastes associated with mold cleaning. It is expected that upon implementation, that a reduction of 3,300 lb/yr of HAPs, and 2,300 lb/yr of VOCs will be realized.

Results

The FY04 program was cancelled in favor of a CO_2 frozen pellet blaster that was thought would successfully clean the molds. That effort failed to demonstrate the required results and this project was restored in FY05. Bids from four subcontractors for low-power, hand-held laser cleaning systems were under evaluation as of 31 March 2006.

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HAZMAT Reduction — Beryllium and Cadmium

ACHA05PV02
FY 2005

Project Information	WS (AMRAAM Missile and AIM-9)
Chemical Being Replaced (pollutants being reduced)	Beryllium and Cadmium
Compliance Driver	Occupational Safety and Health Act (OSHA)
Thrust Area	Coatings
Alternatives Being Addressed	Nickel, Zinc-Nickel, or Teflon-Nickel
Date Implemented	To Be Determined
Recurring Benefits	Elimination of Beryllium and Cadmium
Success Category	To Be Determined

Project Description

This project will begin with an abbreviated Pollution Prevention Opportunity Assessment (P2OA) to specifically trace all uses of beryllium and cadmium at AFP 44 to their source. The project will then split into two paths: 1) Quickly implementing the shelf substitutions for beryllium and cadmium, which will mostly require redirecting suppliers; and 2) Qualifying alternatives that require engineering buy in for material and process substitution. The work will be conducted by a team made up of Materials & Process Engineering, Program Office, Assembly Production Departments, the various customers and EHS personnel. The project may also take advantage of the National Defense Center for Environmental Excellence (NDCEE), where this type of work can easily be conducted without interfering with the production operations at AFP 44.

Results

There were 374 beryllium components on missile and space based weapon systems, of which 117 are on the Exoatmospheric Kill Vehicle (EKV) program. Many of the beryllium bearing components must be replaced with composite-based replacements for hardness. The greatest opportunity for cadmium replacement would be to find alternative coatings to the cadmium plating like nickel, zinc-nickel, or Teflon-nickel. Implementation of this inventory would result in a predicted Annual Savings of $252,500 and payback of 1.9 years. The next step is to validate these alternative materials for beryllium and cadmium.

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Dem/Val Advanced Spray Technologies for Ni/Cr, Phase I

AFMC06LP56
FY 2006

Project Information/Status	Weapons System/ Ongoing, Phase I of IV
Chemical Being Replaced (pollutants being reduced)	Nickel (Ni)/chromium (Cr)
Compliance Driver(s)	Clean Air Act (CAA); Resource Conservation and Recovery Act (RCRA); Occupational Safety and Health Act (OSHA); Superfund Amendments and Reauthorization Act (SARA) 313; EO 13148
Thrust Area	Plating
Alternatives Being Addressed	Alternative thermal spray process
Date Implemented	Implementation Phase IV, projected FY 2009
Recurring Benefits	Predicted elimination of wet electrolytic nickel plating processes at military engine depot by qualifying environmentally friendly affordable alternative(s)
Success Category	To Be Determined

Project Description

This project is follow-on to previous thermal spray projects, which qualified alternatives for wet chrome electroplating at Ogden Air Logistics Center (OC-ALC), but cannot be used on thin-walled components, or components with cooler temperature requirements. The Cold/Kinetic Spray Process can be used to eliminate chemical milling processes. Phase I will accomplish materials testing on gas turbine engine (GTE) substrates using the Environmental Security Technology Certification Program (ESTCP) developed Joint Test Protocol, resulting in a Joint Test Report. There will also be delivery of a Facility Upgrade Plan. Upon successful completion of Phase I (Materials Testing/Test Report, Spray Facility Upgrade Plan, Health Risk Assessment), Phase II activities will be the identification of engine components amenable to this repair process and coating the components for inclusion in an Accelerated Mission Test (AMT), Phase III, followed by implementation, Phase IV.

Results

Proposed process would replace 40% of nickel plating in the depot, which equates to an annual cost savings of $151K. The return on investment (ROI) is predicted to be approximately 4 years (calculated 3.98 years).

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Evaluate Hydraulic Fluid Purification, Phase III

AFMC05PV06/AFMC06PV06
FY 2005/FY 2006

Project Description

This three-phase project will reduce the second largest waste stream in the Air Force by at least 60% through the implementation of on-site purification and immediate reuse of hydraulic fluid. Phase I and II were previously conducted as a two-phase USAF Qualification Operational Test and Evaluation (QOT&E). Results of the HTS Purification in Phase II testing determined the Pall Purifier as user friendly, required very little manpower, and no additional fluid/filter changes were required to decontaminate a dirty HTS (mule). A Limited Field Trial of both the Pall and Malabar International Fluid Purifiers will be conducted as Phase III (AFMC06PV06). The current project effort is to continue the fluid sampling program for year two of the HFP Field Trials, where 4 stand alone purifiers at 4 different locations (2 from each currently qualified manufacturer) are used to clean existing mule reservoirs and aircraft. The fluid will be sampled from operating aircraft and hydraulic test stands to determine the effectiveness of the purification process and standard field practices will be established for the purification process by in-field testing.

Hydraulic fluid purification (HFP) has several operational and cost saving advantages. Fluid purification is expected to increase the hydraulic component life/mean time between failure (MTBF) and decontamination of mules with a purifier takes one half the time and minimal material costs. This reduces the maintenance and total operating costs of all affected systems: aircraft, flight line ground support, and back shop/overhaul shop test equipment. It is estimated $6.7 million annual savings will be realized in both new fluid procurement costs and waste fluid disposal costs. The simple payback is currently estimated at approximately 15 months. Additional savings are expected from increased component life, fewer aircraft hydraulic systems and support equipment maintenance, which reduces costs for spare parts acquisition and overhaul.

Project Information/Status	Weapons System/Ongoing, Year 2 of Phase III/III
Chemical Being Replaced (pollutants being reduced)	Hydraulic fluid (reductions in both new fluid procurement and waste fluid)
Compliance Driver(s)	Solid Waste Disposal Act , E.O. 13101; 40 CFR 279
Thrust Area	Fluids and Lubricants
Alternatives Being Addressed	Hydraulic Fluid Purification (HFP)
Date Implemented	Initiated FY 2007 projected completion FY 2012
Recurring Benefits	Predict an estimated $6.7 M in fluid procurement and disposal costs alone
Success Category	To Be Determined

Results

Originally, there was a delay in fielding a new HTS (mule) with an onboard purifier, consequently it was determined by the HFP integrated project team (IPT) to proceed with HFP USAF-Wide implementation, temporarily using stand alone purifiers until the HTS was redesigned and fielded. It was determined more cost effective to use stand alone purifiers, because it would reduce new mule procurement costs by about $30,000 each. One or two purifiers could possibly service a whole fleet of mules at any one location, depending on the number of mules there.

The current evaluation effort is projected to end after FY 2007, after which a complete transition in the USAF of the HFP process will occur. It is now anticipated that full transition of HFP to the field with stand alone purifiers will take 4 years. Stand alone purifiers can then be used in aircraft back shops, aircraft Programmed Depot Maintenance lines, actuator overhaul and test facilities, and on aircraft at the user's discretion and with program office approval.

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Nonchromated Fuel Tank Coating (AMS-C-27725)

ACFJ05PV01
FY 2005

Project Information/Status	WS (F-16 and C-130); Ongoing
Chemical Being Replaced (pollutants being reduced)	Hexavalent chromium (Cr-VI)
Compliance Driver(s)	Occupational Safety and Health Act (OSHA)
Thrust Area	Coatings
Alternatives Being Addressed	Nonchromated, low-volatile organic compound (VOC) alternative fuel tank coating
Date Implemented	To Be Determined
Recurring Benefits	To Be Determined
Success Category	To Be Determined

Project Description

This project will attempt to qualify a nonchromated, low-VOC candidate for operations currently using fuel tank coating, AMS-C-27725. Currently, Lockheed Martin Aeronautics is testing two nonchromated, low-VOC seal bond primer candidates to seal bond requirements. These seal bond candidates look promising. Additionally, a cerium based, nonchromated fuel tank coating primer is being developed, and if available, will be tested. Full qualification and implementation (if oven facilities allow) will be made with the preferred candidate.

Results

The predicted cost-savings of this project is based on the assumption that the new OSHA exposure limit would require additional occupational exposure controls, monitoring, and personal protective equipment. Expenses are similar to those expenses estimated and documented in 1995 for compliance to the cadmium OSHA standard. Payback is predicted to be 3 years.

Contact Information

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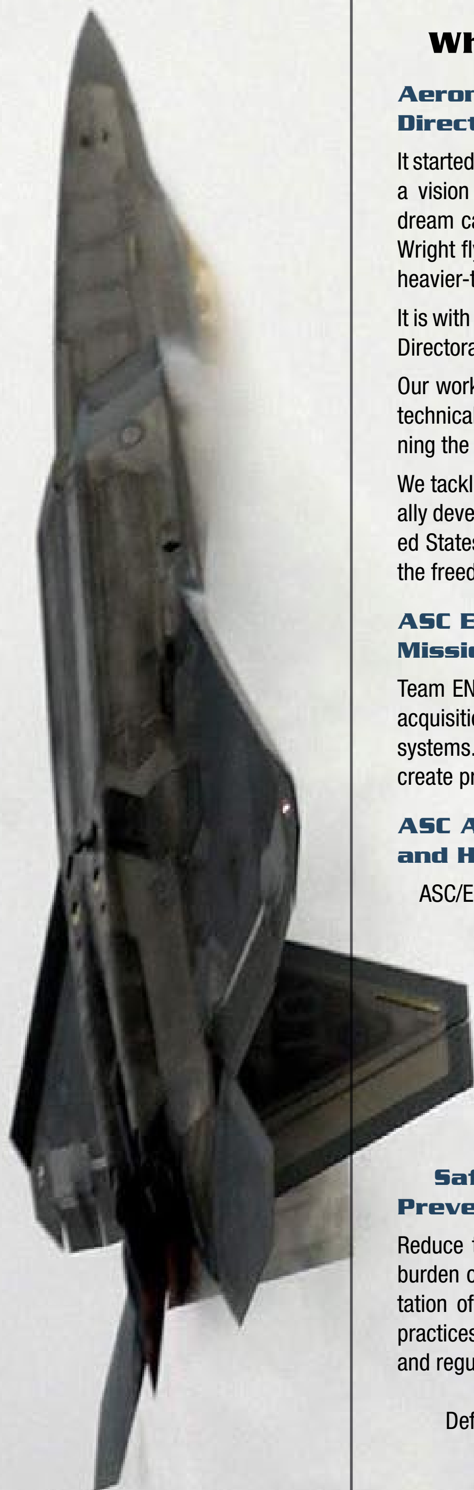
Photo Credits

Cover and Page 2	OVER THE UNITED STATES (AFPN)— An F-22A Raptor from Langley Air Force Base, VA, refuels with a KC-135 Stratotanker from McConnell AFB, KS, during the Raptor's first operational mission Jan. 21. (U.S. Air Force photo/Master Sgt. Maurice Hessel)
Page 4	SNOWY NIGHT—A member of the 436th Aircraft Maintenance Squadron here clears snow around a C-5 Galaxy early Jan. 26. (U.S. Air Force photo/Lt. Col. Jon Anderson)
Page 6	THE FUTURE FIGHTER—The application of advanced avionics software in the F/A-22 is key to the Raptor's revolutionary performance advantage over any other fighter. (U.S. Air Force photo/Kevin Robertson)
Page 11	Courtesy ASC.ENVV (Deicing CoP)
Page 13	C-17 AIRDROP TRAINING MISSION—Heavy equipment pallets fall from C-17 Globemaster IIIs May 16, 2006, during an airdrop training mission. (U.S. Air Force photo/Tech. Sgt. Shane A. Cuomo)
Page 14-15	SNOW-COVERED C-17S—Several days of storms left 6 inches of snow covering C-17 Globemaster IIIs at Ramstein Air Base, Germany, on Friday, March 3, 2006. The 435th Civil Engineer Squadron's large vehicles and equipment section worked nonstop keeping the runways and taxiways clear. (U.S. Air Force photo/Master Sgt. John E. Lasky)
Page 17	Courtesy ASC.ENVV (Deicing CoP)
Page 18	SOTO CANO AIR BASE, Honduras—Soldiers and Airmen hang 100 feet above the ground from a UH-60 Blackhawk here recently. (U.S. Army photo/Sgt. Jorge Gomez)
Page 19	OVER THE PACIFIC—A B-2 Spirit soars after a refueling mission over the Pacific Ocean. (U.S. Air Force photo/Staff Sgt. Bennie J. Davis III)
Page 19	REAPER MONIKER—The "Reaper" has been chosen as the name for the MQ-9 unmanned aerial vehicle. (U.S. Air Force photo)
Page 21	F-22S ARRIVE AT ELMENDORF FOR EXERCISE—An F-22 Raptor taxis after landing at Elmendorf Air Force Base, Alaska. (U.S. Air Force photo/Staff Sgt. Dave Donovan)
Page 22-23	Courtesy ASC.ENVV (Deicing CoP)
Page 25	RAPTOR IN FLIGHT—(U.S. Air Force photo)
Page 26-27	ABOARD USS JOHN F. KENNEDY— An F/A-18 Hornet assigned to the "Gunslingers" of Strike Fighter Squadron One Zero Five (VFA-105), is launched from the flight deck aboard USS John F. Kennedy (CV-67). (U.S. Navy photo/Photographer's Mate 3rd Class Joshua Karsten)
Page 30-31	Courtesy E&HWG, Tyndall AFB
Page 33	ABOVE THE MOJAVE DESERT—With approximately 80 percent of development complete and two test aircraft flying, the F/A-22 Raptor program is nearing completion of a 13-year development program. (U.S. Air Force photo/Judson Brohmer)
Page 34	AIR SHOW TO SHOWCASE C-17'S CAPABILITIES—A C-17 Globemaster III practices aerial maneuvers Sept. 27 over Kona International Airport in Hawaii to prepare for an upcoming air show. (U.S. Air Force photo/Tech. Sgt. Shane A. Cuomo)
Page 36	HERITAGE FLIGHT—An F-22A Raptor from Langley Air Force Base, VA, flies in formation during the 2006 Heritage Conference. (U.S. Air Force photo/Airman 1st Class Veronica Pierce)
Page 39	PRETTY RAPTORS ALL IN A ROW—Lt. Col. James Hecker (front) and Lt. Col. Evan Dertein line up their F/A-22 Raptor aircraft behind a KC-10 Extender to refuel while en route to Hill Air Force Base, Utah. (U.S. Air Force photo/Tech. Sgt. Ben Bloker)
Page 40	ARCTIC THUNDER—An F-22 Raptor hovers vertically above the Arctic Thunder air show and open house at Elmendorf Air Force Base, Alaska, on Aug. 13. (U.S. Air Force photo/Airman Jonathan Steffen)

U.S. AIR FORCE

MONITOR

Aeronautical Systems Center, Acquisition Environmental, Safety, and Health Division, Pollution Prevention Branch (ASC/ENVV)



ASC/EN/ENV/ENVV: Who We Are and Our Mission

Aeronautical Systems Center, Engineering Directorate—Who We Are

It started as a dream. Two brothers, Orville and Wilbur Wright, shared a vision to build a flying machine. Dayton natives, the Wrights' dream came true on December 17, 1903, when Orville piloted the Wright flyer on the world's first powered, sustained, and controlled heavier-than-air flight. It was the birth of aviation.

It is with great pride that almost a century later, the ASC Engineering Directorate continues to carry on the Wright Brothers' legacy.

Our workforce is multi-disciplined with engineers providing expert technical guidance across distinctive engineering disciplines spanning the entire life cycle of acquisition from cradle to grave.

We tackle the tough problems while guiding technology to continually develop and improve aircraft and their systems, giving the United States Air Force the leading edge in defending and maintaining the freedom of our great nation, The United States of America.

ASC Engineering Directorate's (ASC/EN's) Mission

Team EN provides superior technical support for the development, acquisition, and sustainment of the world's finest military aerospace systems. We advance the people, policies, processes, and tools that create practical technological solutions for the warfighter.

ASC Acquisition Environmental, Safety, and Health Division's (ASC/ENV's) Mission

ASC/ENV is the Air Force's executive agent in managing all USAF-owned industrial plants, including facilities management, environmental stewardship, and community outreach. The division also provides environmental engineering and program-specific facilities support to ASC's weapon system acquisition programs, including compliance with environmental laws and development of environmentally-friendly processes and technology.

ASC Acquisition Environmental, Safety, and Health Division, Pollution Prevention Branch's (ASC/ENVV's) Mission

Reduce the Environment, Safety, and Occupational Health (ESOH) burden of the systems acquisition process through the implementation of innovative pollution prevention processes and business practices while ensuring compliance with applicable laws, rules, and regulations.

Definition source: http://www.engineering.wpafb.af.mil